DroneMachines

by Tristan Shone

DroneMachines

Catalog of MFA Works and Performances
by Tristan Shone
University of California, San Diego
Graduate Department of Visual Arts
Years Attending: 2004 - 2007
MFA Work Span: 2006 - 2008

I would like to thank those who helped and influenced me:
UCSD Visual Arts Department, Scripps Institute of Oceanography Machine Shop, Campus Research Machine Shop at UCSD, Sheldon Brown, Ricardo Dominguez, Scott Richards, Marilia Maschion, and my family.

DroneMachines:Overview

Drone Machines are sound interface devices with an industrial aesthetic and functionality. Each device draws the body into its handles and contours, placing one into physical postures of leverage from invigorating facets of ours lives (contortions of love making, rage, machine control, etc.) relates them with sound. *Drone Machines* are simple, yet powerful extensions of the body, amplifying pleasure found in controlling and manipulating raw sound.

The machines imagine the body inside and around sound, manipulating the contours, stimulating the peaks and resonances, and tasting the textures and lines of brutal raw sound. This state of being pushes you against the bass line, against the wall of sound that pushes back when you attempt to change its form. The sound is a simple linear axis, a drone or drones slightly offset to create resonances. Immersed into and put in command of this environment, one cannot control more than is possible with a single body; there is a battle for equilibrium between human stamina, timing and output. One person is in control of the entire workload, able to sequence and trigger and control at will based upon their own perception. A single human is actually capable of much more than most work environments necessitate. The worker bee is not limited by red tape and industrial standards and inefficiencies, it is ultimately efficient. The human worker can do the same. Rearrange the machine shop so that the part can be completed within arms reach on four machines simultaneously. The worker creates a rhythm in movement. This is the basis of the *Drone Machines*.

The idea of a drone is important to these devices because they are supposed to be simple machines; a return to almost enlightenment era simplicity applied to human interface for music, although these machines could really control anything. They are based around a simple idea or movement, the moon on a clear night. In robotics, automation and control systems, a single

axis is the simplest robotic system, yet there is amazing versatility within moving in a straight line: different patterns back and forth, or in rotating one way or the other at different speeds and profiles. Similarly, a drone is a single monotonous tone. On first listen, it appears not to change but listening more closely you notice that it has contour and changes slightly. Your tempo adjusts and slows to the sinusoid of the tone and aligns itself with the single drone axis. You begin to notice layer upon layer making up just one tone as your attention is undivided.

Drone Machines are a series of devices that can be played together as slowly overlapping axes with different properties. The culmination of these sounds at intense audible levels through interaction with these manual momentous systems, is an ultimate moment of sensory eroticism.

Drone Machines, 2007.

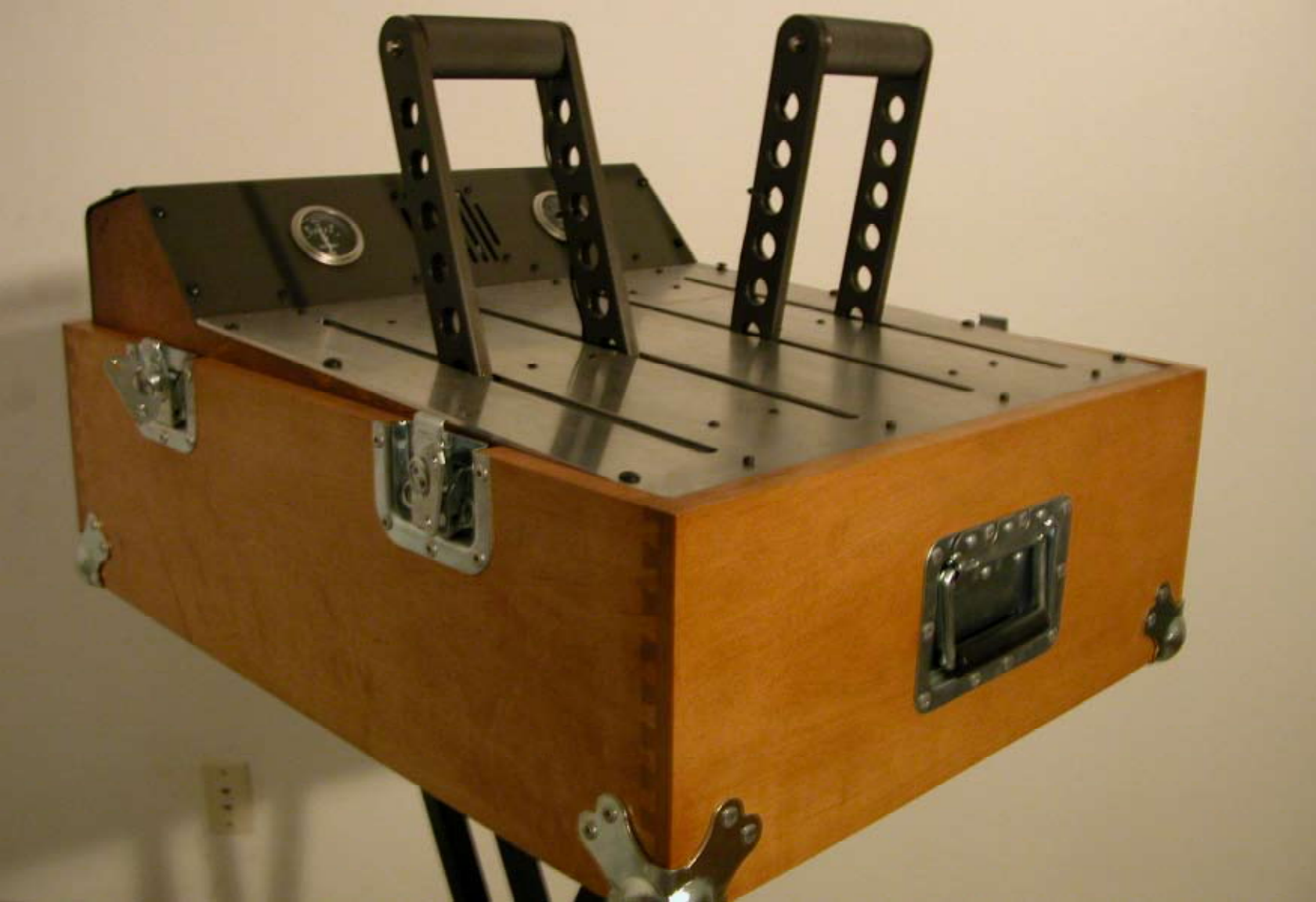
DroneMachines:Throttles

The first of the *Drone Machines*, entitled *Throttles*, is a dual pitch controller with force feedback and autopilot options. The two handles are geared to two high-torque DC motors with quadrature encoder feedback. Each operates under a standard adjustable gain PID (proportional, derivative, integral) control algorithm which engages force feedback at designated points, set by a panel switch. The PID also allows motions or pitch sequences to be "recorded" and then replayed by the robotic system, resulting in an "autopilot" function. This is not to be confused with sampling, where the audio is recorded and that sample replayed.

The *Throttles* has the overall look and feel of a military field device or early aircraft control panel, without the cold and confusing complexity of a plethora of knobs and switches. It's a portable piece of equipment with rugged handles, corners and completely built into a hard finished maple travel case complete with dovetail joints. The case is clearly handcrafted and shows some field wear, however upon unlatching and removing the top of the case, the panel and throttles are revealed; a stark contrast as they have been machine fabricated, culminating together as a stern yet elegant device.

Approaching the device even before it's turned on, one's hands are drawn to the handles and eyes to the dial indicators which show levels of current, indicating motor torque. You are immediately placed into a readied position awaiting some potential surge; leaning forward, one leg slightly behind the other, hands raised in front. The perforated throttle arms, knurled handles, metal frame and overall mass of the machine indicate something significant that can handle your weight and deliver pain. Powering on the device brings the two throttles perfectly erect in unison as the power supplies and fans within, wind up and whistle softly; the current dials flicker and equalize at zero amps.

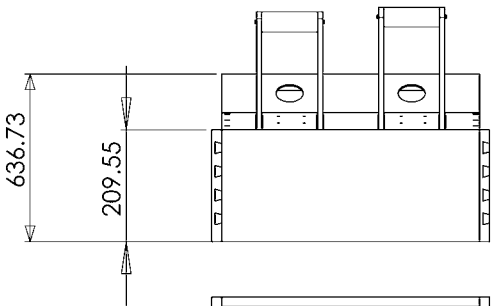
Throttles, 2006.

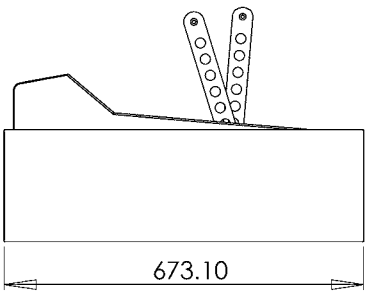


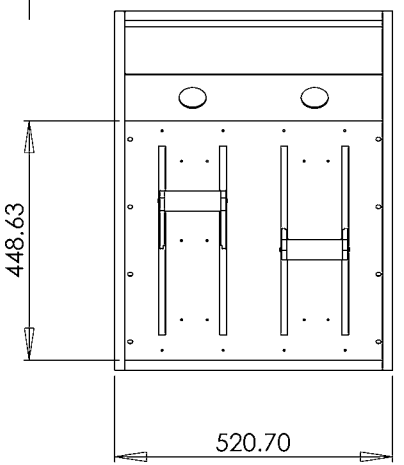
FUNCTIONAL OVERVIEW:	
PITCH CONTROL.....	0 to 128*.
VOLUME CONTROL.....	0 to 128*.
POSITION LOCK.....	Toggle switch to engage PID closed loop position control loop for maintaining pitch.
RECORD REPLAY.....	Foot switch to enable record motion loop and then replay*.
	*Re-assignable/re-programmable through Atmel via USB/ RS232.
MECHANICAL SPECIFICATIONS:	
MATERIALS.....	Maple wood (case), anodized aluminum (throttles, instrument panel, and internal frame), stainless steel (throttle panel).
MOTOR TORQUE.....	100in.lb torque.
DRIVE TRAIN.....	Chain-driven 3/1 gear ratio.

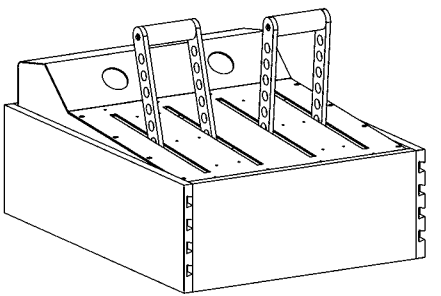
ELECTRICAL SPECIFICATIONS:	
SUPPLY VOLTAGE.....	120VAC (wall supply).
ONBOARD POWER.....	12VDC/24VDC, 6A power supply (1 internal fan cooled supply for each motor).
CURRENT READOUT...	2 +/- 10A DC current readout on panel.
MOTORS.....	2x24VDC, 6A servo motors with 5VDC quadrature encoder feedback for PID control and force feedback.
INPUT.....	2x100k potentiometer in each handle to read resistance for volume control. 2 toggle switches.
CONNECTIONS.....	MIDI (out), 6pin
EMBEDDED.....	Atmel atmega 32, 8 bit microcontroller, based upon the Number 6.

Throtttles Technical CAD Drawing.









UNLESS OTHERWISE SPECIFIED:		NAME	DATE
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	ENG APPR.		
	MFG APPR.		
INTERPRET GEOMETRIC TOLERANCING PER:	Q.A.		
MATERIAL MAPLE/STEEL/AL	COMMENTS: MAPLE COVER NOT SHOWN		
FINISH			
DO NOT SCALE DRAWING			

DRONE MACHINES 2006

TITLE:

THROTTLES

SIZE	DWG. NO.	REV
A	DM1.0	1
SCALE: 1:10	WEIGHT: 115LBS	SHEET 1 OF 1

5 4 3 2 1

DroneMachines:Bellows

The second of the *Drone Machines*, entitled *Bellows*, is a vocal beatbox sampler/controller module. Comprised of a microphone and 5 channels of mappable faders and buttons, this unit allows you to compose up to 5 tracks of simultaneous vocal audio looping. An external sequencer attached via USB/MIDI is required (either hardware or software). The device contains a custom made tapered 8x10 to 4x6 vinyl bellows, which houses the microphone and is fully collapsible into the box. The *Bellows* box also has a similar portable sensibility that the Throttles conveys, but the style appears slightly more customized and stylish. Even with the cover closed not revealing the contents, the contrast of the vintage looking cherry wood case combined with the hard and acute lines of the matching clear anodized hardware (hinges, corners, latch etc.), still put off an air of contemporary design hinting at something high tech within.

The surprisingly heavy lid opens slightly past vertical held by custom lid supports and contains a polished stainless steel control panel with unlabeled buttons and faders, totaling 5 channels. Inside, exists a compressed and very compact mechanism made up of the same anodized aluminum, cherry and black vinyl. Grabbing the two disc handles and pulling the assembly upwards, extends the two scissor supports and reveals a decompressing tapered vinyl bellows with a mouthpiece, or customized microphone at its end. The two handles aluminum discs double as a locking mechanism once the microphone has been pulled up and rotated into place and also handles with which to hold onto. The *Bellows* was designed in the likeness and precision of the vintage large format cameras, with elements of the fine hardware lines and adjustable mechanisms.

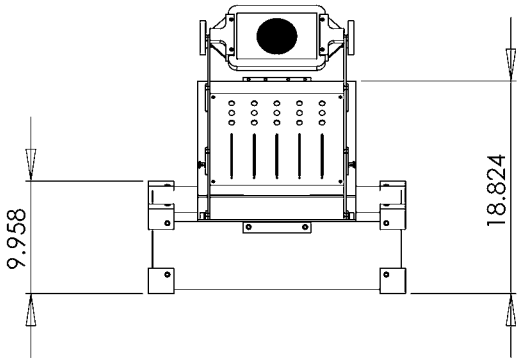
The whole device is angled towards the user, from closed to sprung, and in standing in front of it, the mouth is almost sucked towards the microphone as if by an organism or respiratory diagnostic system. The *Bellows* beckons you to exhale, regurgitate, and vent your inner rumblings into the inner workings of this sound "sink".

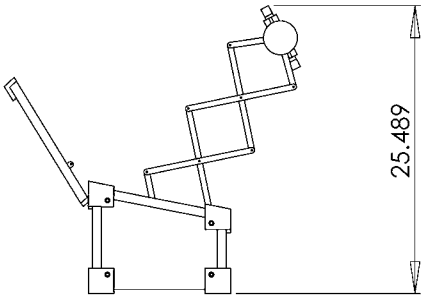
Bellows, 2007.

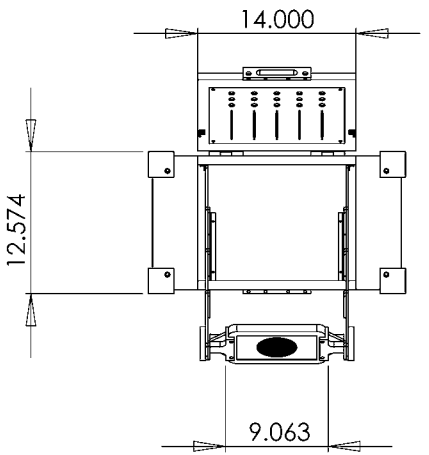
FUNCTIONAL OVERVIEW:	
VOLUME CONTROL.....	0 to 128*.
GENERAL BUTTON.....	3 per channel momentary pushbutton*.
	*Re-assignable/re-programmable through Atmel via USB/RS232.
MECHANICAL SPECIFICATIONS:	
MATERIALS.....	African cherry (case), anodized aluminum (adjustment hardware and corners), stainless steel (control panel), vinyl (bellows).

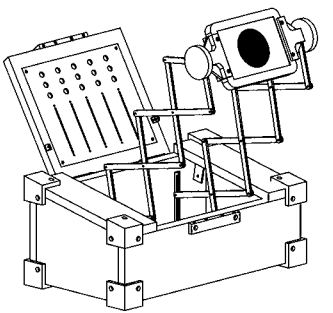
ELECTRICAL SPECIFICATIONS:	
SUPPLY VOLTAGE.....	12VADC (wall supply) .
INPUT (mappable).....	5x100k linear faders/potentiometers 15 momentary pushbutton switches.
CONNECTIONS.....	MIDI (out), 6pin, XLR (out) microphone out.
EMBEDDED.....	Atmel atmega 32, 8 bit microcontroller, based upon the Number 6.
MICROPHONE.....	2x100k potentiometer in each handle to read resistance for volume control. 2 toggle switches.
CONNECTIONS.....	MIDI (out), 6pin.
MICROPHONE.....	Dynamic.

Bellows Technical CAD Drawing.









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	ENG APPR.		
	MFG APPR.		
INTERPRET GEOMETRIC TOLERANCING PER:	Q.A.		
MATERIAL CHERRY/STEEL/AL	COMMENTS: VINYL BELLOWS NOT SHOWN		
FINISH			
DO NOT SCALE DRAWING			

DRONE MACHINES 2007

TITLE:

BELLOWS

SIZE	DWG. NO.	REV
A	DM2.0	1
SCALE: 1:12	WEIGHT: 50	SHEET 1 OF 1

5 4 3 2 1

DroneMachines:LinearActuator

The third of the *Drone Machines*, entitled *Linear Actuator*, is a an open source drum trigger. The machine is made up of a weighted sliding handle and spring loaded plungers at either end to stop the handle. This device contains a trigger switch and a linear encoder, to monitor the position of the handle. The default configuration, or programming mode, outputs velocity and note information depending upon the linear position of the slide and the trigger position. Different combinations of trigger with end hit output combinations and different sounds, which are all re-programmable. The note hits can happen anywhere on the length of the slide, at intervals, or can control note pitches, oscillations, etc. The slide handle has significant linear inertia due to a solid aluminum construction with adjustable high density steel inserts, forcing the user to work and also anticipate the hits and thus the rhythm.

The *Linear Actuator* looks, at a glance, reminiscent of an early 20th century table top lathe with some machined, cast and even hand wrought elements. Unlike the first two devices, which contain an element of the "black box" with much of the mechanism out of site, the *Linear Actuator* is an open book. Observing the device for the first time, one can immediately understand what this device does and how it mechanically functions, beside the fact that it outputs sound data processed by the microcontroller that is hidden away in one end. The concept of linear motion is the most prevalent upon viewing this machine, with the two long hardened steel rods stretching over the 3 foot length, smeared with a fragrant bluish grease. The device is clearly right-handed and slides along the length of the rods, given away by the handle, which is a hand carved joining of ebony and steel, much like a revolver grip. The base of the device is bolted onto a maple butcher block top anchored by a square tube steel table weldment, which is then backed by sandbags on the floor; this device expects the user to slam the slide into each spring-loaded impact point with significant force, its brutality evident by the wear seen on the steel plates that contact the compression springs and the smoothing of the steel and ebony on the handle. Despite the cold steel lines and

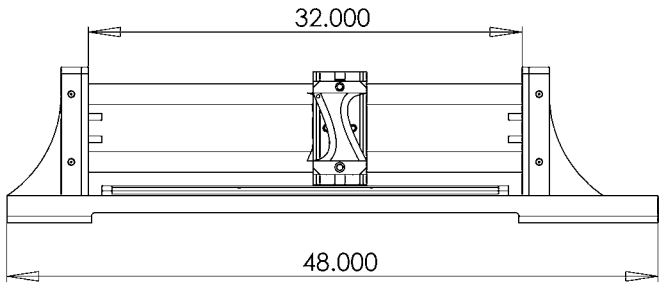
Linear Actuator, 2007.

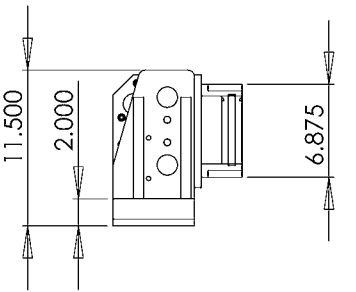
harsh functionality of the device, there is something comforting and warm about the *Linear Actuator*, that separates it from haggard machine shop and transports you more into the realm of your jackknife, handgun, or prized caliper/micrometer set, slightly oiled and kept in a velvet-lined wood case. As your hand slides in place, naturally yet firmly gripping the wood handle, you test the weight and linear inertia, your stance widens.

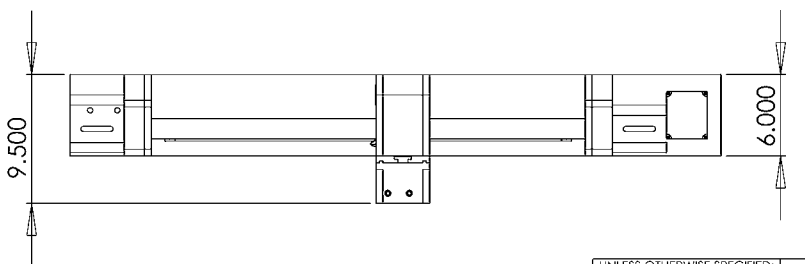
FUNCTIONAL OVERVIEW:	
LINEAR POSITION.....	Completely programmable for any number of hits/notes at any position. Default: note out at 0, note out at 3600*.
TRIGGER.....	Note out*.
	*Re-assignable/re-programmable through Atmel via USB/RS232.
MECHANICAL SPECIFICATIONS:	
MATERIALS.....	Aluminum with green hammer finish, steel, hardened stainless steel (linear rod, bearings), ebony wood (handle), nylon (wire harness).

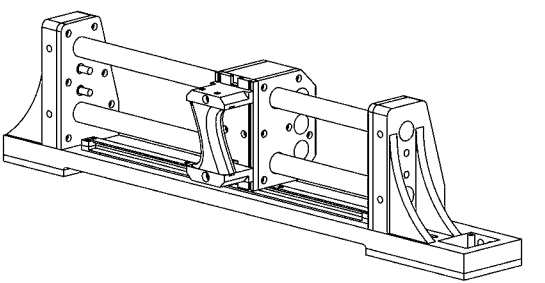
ELECTRICAL SPECIFICATIONS:	
SUPPLY VOLTAGE.....	12VDC (wall supply)
INPUT.....	3600 count quadrature linear encoder (36 inches), Momentary pushbutton trigger switch.
EMBEDDED.....	Atmel atmega 32, 8 bit microcontroller, based upon the Number 6.
CONNECTIONS.....	MIDI (out), 6pin.
EMBEDDED.....	Atmel atmega 32, 8 bit microcontroller, based upon the Number 6

Linear Actuator Technical CAD Drawing.









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	ENG APPR.		
	MFG APPR.		
INTERPRET GEOMETRIC TOLERANCING PER:	Q.A.		
MATERIAL EBONY/STEEL/AL	COMMENTS: WIRE HARNESS NOT SHOWN		
FINISH			
DO NOT SCALE DRAWING			

DRONE MACHINES 2007

TITLE:

LINEAR ACTUATOR

SIZE	DWG. NO.	REV
A	DM3.0	1

SCALE: 1:10 | WEIGHT: 225LBS | SHEET 1 OF 1

5 4 3 2 1

DroneMachines:RotaryEncoder

The newest of the *Drone Machines*, entitled *Rotary Encoder,* is a rotary pitch controller containing a quadrature rotary encoder on the shaft of the disc that reads the position, direction and velocity. The default output mode controls the pitch of two notes, one for each direction, where the velocity of the disc corresponds to note pitch. The configuration is re-programmable, so that position can control pitch, or different directions can have different start points or control different parameters (oscillation frequency, resonance, panning, etc.). The focus with this device lies in the rotational inertia of the disc in relation to human strength, so that the change in direction and acceleration of the wheel is not a trivial exercise. In addition, strong emphasis was placed on precision machining and selecting a high quality thrust bearing to assure perfectly smooth rotation of the 300 lb. disc.

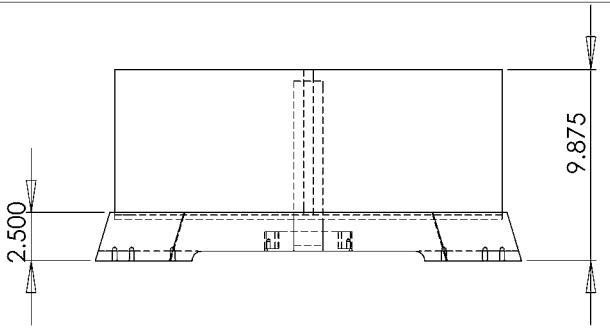
The *Rotary Encoder* was conceived of and designed alongside the *Linear Actuator* as its circular counterpart. As linearly simple as the former appears, the *Rotary Encoder* is comprised of a base with a large 22 inch diameter steel disc on top of it. Other than five screw holes in the center of the disc and two plug receptacles, the two pieces are seamless and clearly CNC machined. Vaguely reminiscent of a turntable, resting at waist height, the only thing one can do is spin the wheel. Of course, when you actually turn the disc, the large rotational inertia reminds you that the dynamics of a spinning body extend beyond start and stop; you can change speed, acceleration, direction, and create different waveforms, all using your hands and your body weight. One facet that is more apparent and interesting on this device than on the other *Drone Machines*, is the that of wear. The disc is made of cold rolled steel and can therefore rust slowly over time. The marks of manipulation have clearly become visible on the middle of both the outside diameter and the top of the disc as hands slowly polish the surface with their mineral oils, as if it were being turned on a lathe.

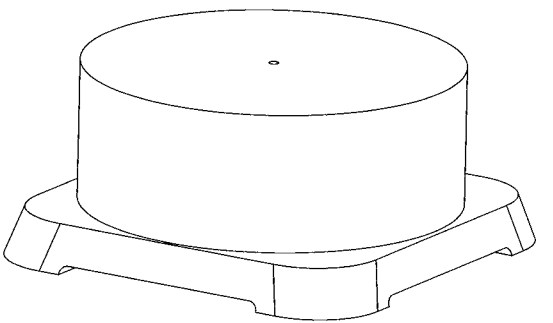
Rotary Encoder, 2007.

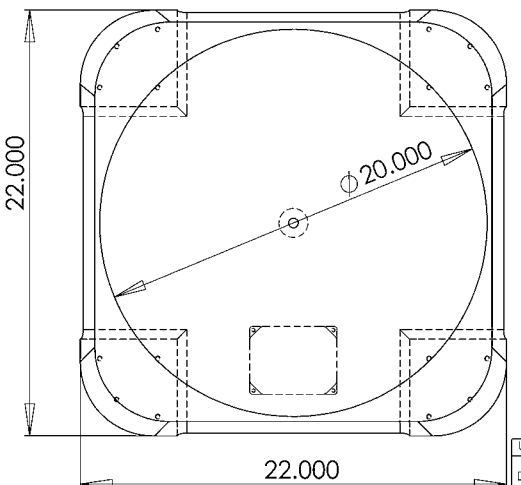
FUNCTIONAL OVERVIEW:	
PITCH CONTROL.....	Bidirectional pitch control. Default configuration: CL note on upon rotation and faster speed increases pitch; CCL, different note on and faster speed increases pitch.*
	*Re-assignable/re-programmable through Atmel via USB/RS232.
MECHANICAL SPECIFICATIONS:	
MATERIALS.....	Aluminum (base), steel (disc).
ROTATION.....	High load thrust bearing.

ELECTRICAL SPECIFICATIONS:	
SUPPLY VOLTAGE.....	12VDC (wall supply)
INPUT.....	3600 count quadrature rotary encoder.
CONNECTIONS.....	MIDI (out), 6pin.
EMBEDDED.....	Atmel atmega 32, 8 bit microcontroller, based upon the Number 6.

Rotary Encoder Technical CAD Drawing.







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	CHECKED		
	ENG APPR.		
	MFG APPR.		
INTERPRET GEOMETRIC TOLERANCING PER:	Q.A.		
MATERIAL STEEL/AL	COMMENTS:		
FINISH			
DO NOT SCALE DRAWING			

DRONE MACHINES 2007

TITLE:

ROTARY ENCODER

SIZE	DWG. NO.	REV
A	DM4.0	1

SCALE: 1:10 | WEIGHT: 350LBS | SHEET 1 OF 1

5 4 3 2 1

DroneMachines:Performance

Having played in various metal bands from the age of 16 on, music has always been a driving component in my life, especially when other aspects have turned sour, however it has existed as a separate entity, until recently. With the *Drone Machines*, I found a way for each step of the process to entertain and interest me, something which lacked with previous projects that were only satisfying during the conception and fabrication phases. Ultimately, I was to create my own biomechanical music machine, played by me, with no sequences, moving at my pace yet emanating my musical tone. Even though the sounds and oscillations are mostly sampled and recognizable, the interfaces are new and unique. I had to rid of some of the guitar and drums because of their performative inefficiency, often requiring both hands and all of your attention. The *Drone Machines* were designed to be played together and by one person, where you can work among them and navigate the controls with hands on different devices simultaneously and feet controlling effects or changing settings.

The setup borders on ridiculous, but both its limits and exotic nature push the creative realm into uncharted territory. One wouldn't think that playing a sound by pressing a plastic button would be different than sliding a weighted handle with bearings along hardened steel rod into a spring loaded stop. Actually it isn't different, they play the same sound in this case, however, for the performer it is worlds apart. The action now carries weight: it has united the effect with its cause. Although developments in sound and electronics were ample, the dawn of electronic music more or less separated music and performance from the laws of physics. For such strong and powerful music, so little physical effort must be exerted and song writing clings to quantizing beats due to an almost musical sloth. The *Drone Machines* have allowed me to truly improvise and perform to my physical and mental limits, bonding me with my music.

Drone Machines, 2007.


DRONE
MACHINES
JESUS
Marshall

Throttles (live performance)
727 Gallery, Los Angeles, CA
December 14, 2006.

Practice Sessions
UCSD, 2007.

Drone Machines (live performance)
Greater Los Angeles MFA Exhibition
CSU Long Beach, CA
September 9, 2006.


open

Drone Machines (live performance)
MFA Exhibition, UCSD, La Jolla, CA
June 15, 2007.

DroneMachines:Conclusion

What really stands out with these devices and with machine tools in general is the hierarchy of precision required for different parts of a machine, which is much like the human body. The structural support members and topical coatings: the handles, the tables, the legs, the skin, the paint, the nails, the hair are not an exact science. These elements are approximated and take on a hand wrought look. However, slicing into the skin with a surgical knife exposes vital organs: extreme tolerance slide bearings, anneal hardened and polished rod, buried in a sack of high speed bearing grease, perfectly calibrated as if years of evolution had corrected any misalignment. Likewise, electrically, cracking open the skull case discloses neurological networks of micron precision quadrature encoders with fine line graduated glass scales, all communicating through fiber networks with a master chip in a closed loop control algorithm. Both levels of precision rely on each other, in an almost utopian societal class system of functionality. Both levels are made of the same stuff; running a carbide end mill across a rough steel casting with no surface finish, shows an amazingly silver flat surface, much like splitting wood along its natural veins where you find incredibly smooth surfaces lined with sap, suddenly it is a calibration standard. In this way, a machine is a beautiful organic entity, and this is what I have tried to create with the Drone Machines.

Linear Actuator (live performance)
Mountain Bar, Los Angeles, CA
February 29, 2008.


Marshall

TristanShone:ExhibitionHistory

SOLO/GROUP

2007

"MFA @ The Egyptian", University Art Gallery, UCSD, La Jolla, CA. December 2007.
"Greater Los Angeles MFA Exhibition", California State University, Long Beach, CA. September 2007.
"San Diego Art Prize: New Contemporaries", Simay Space, San Diego, CA. June 2007.
"Drone Machines: MFA Exhibition", Marcuse Gallery, UCSD Visual Arts Department, La Jolla, CA. June 2007.
"Origin is the Goal", LACE (Los Angeles Contemporary Exhibitions), Los Angeles, CA. May 2007.

2006

"Throttles", Gallery 727, Los Angeles, CA. December 2007.
"Where", San Francisco, CA. July 2006.
"Where", Sundown Salon, Los Angeles, CA. May 2006.
"SouthwestNET:Techno", Scottsdale Museum of Contemporary Art, Scottsdale, AZ. January - May 2006.

2005

"Que Traes", Estacion Tijuana, Tijuana, BC, Mexico. May 2005.

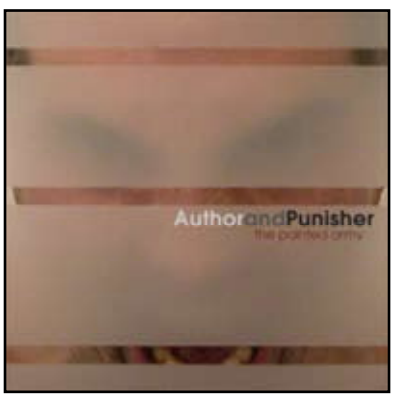
COLLABORATIVE

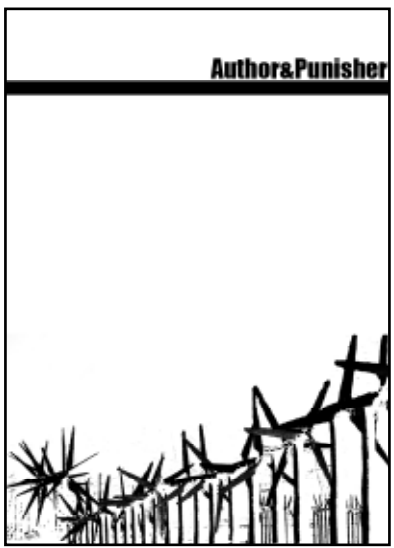
"Particles of Interest: Tales from the Matter Market" by Ricardo Dominguez and Diane Ludin, House of World Culture, Berlin, Germany. October 2007. ISEA 2006, San Jose, CA. August 2006.
"Dreams/Nightmares" by Ricardo Dominguez, InSite05, Tijuana, BC, MX and San Diego, CA. September 2005 and January to May 2006.
"Skin/Control" by Chris Csikszenmihalyi, Location 1, Manhattan, NY. September 2004 to February 2006.
"Natural Language Processor " by Chris Csikszentmihalyi, Alien Intelligence , Kiasma Museum of Contemporary Art, Helsinki, Finland. February to May 2000.

Author&Punisher

AUTHOR & PUNISHER *DRONE MACHINES* 2007 TOUR DATES
9/22/07- Soundwalk2007 at Koo's Art Center, Long Beach, CA.
9/18/07 - Rotture, Portland, OR.
9/15/07 - The Terminal, Oakland, CA.
9/9/07- Greater Los Angeles MFA Exhibition at California State University, Long Beach, CA.

AUTHOR & PUNISHER RELEASES
"Windmills", 30 Minute DVD, 2007.
"Warcry", 4 Song EP, 2007.
"Where", Limited Edition CD Compilation, 2006.
"The Painted Army", 6 Song LP, 2005.





CurriculumVitae

EDUCATION
MFA in Visual Arts, University of California, San Diego, 2008.
BS in Mechanical Engineering, Rensselaer Polytechnic Institute, 2000.

WORK
National Center for Microscopy and Imaging Research (NCMIR)- Mechanical Engineer, UCSD, La Jolla, CA (1/2007 - present).
University of California, San Diego (Visual Arts Department)- Teaching Assistant, UCSD, La Jolla, CA (9/2004 - 12/2006).
MicroCHIPS- Mechanical/Test Engineer, Bedford, MA (3/2004 - 8/2004).
PerkinElmer Life and Analytical Sciences- Mechanical Engineer, Boston, MA (12/2002 – 8/2003).
Corning IntelliSense- MEMS Test/Systems Engineer, Wilmington, MA (1/2001 – 9/2002).
Center for Automation Technologies- Research Engineer, RPI, Troy, NY (3/1998 – 5/2000).

PUBLICATIONS
“Design and Fabrication of a Novel Electrostatically Actuated 1296 Micromirror Array for Optical Cross Connects”, T.D. Kudrle, T.M. Shone, et al, Proceedings of the 16th Annual IEEE International MEMS Conference, Kyoto, Japan, Jan19-23, 2003.
“Single-crystal silicon micromirror array with polysilicon flexures”, T.D. Kudrle, T.M. Shone, et al, Sensors and Actuators, March 14, 2005.