1

2

3

4

1

2

3

4

1

2

3

4

Speaker

Audio L/R, USB cable

Eye LEDs

Head Nod Servo

GoBilda

2000-0025-0002

Head Nod Servo Cntrl

Gnd

6V

1

2

3

4

Head Rotate Servo

HS-7954SH

Gnd

6V

Gnd (LEDs)

Back 4-Way 5-Port Solenoid Valve which is connected to the back pneumatic cylinder to move the back up/down. Part # HB-2A0A FrightProps.com

Back Cntrl

(black wire)

Short - Back up   
Open - Back down

12V

(red wire)

**4**

**3**

**1**

**2**

Head Rotate Servo Cntrl

Mic Jack at Prop

To Audio Src L/R

1

2

3

4

Mouth Servo

HS5245MG

Mouth Servo Cntrl

Gnd

6V

**5**

Electret Mic Amp (for hearing at prop)

Gnd

4.5V bat

Audio Out

Arm Pitch Servo

GoBilda

2000-0025-0002

Arm Roll Servo

GoBilda

2000-0025-0002

ArmYaw Servo

GoBilda

2000-0025-0002

Elbow Pitch Servo

GoBilda

2000-0025-0002

Arm and Elbow servo connections use std 3 pin servo connectors. Each is labeled with tape as to which servo it goes to

Two 7-wire Sprinkler cables are used from the controller to the Prop (18 gauge wire can handle 16 amps max). Any pin of the connectors can handle at most 8 amps. 6V power supplies are either 3 amp or 6 amp supplies. Air cylinder solenoid valve draws at most 2.5/12 = 0.21 amps but requires circuitry as shown below to drive the Air cylinder relay to reduce flyback problems (non turn off). LEDs draw maybe 20 milliamps combined with 500 ohm resistor in series. Servo heavy duty twisted 3 wire cables are used for all other connections from the controller to the prop along with universal servo wire connectors for quick connect/disconnect.

E

B

C

Air Cylinder Solenoid Valve Red wire

Digital Relay Cntrl In

Arduino Mega Pin 23 (PA1)

12 V

4-Way 5-Port Solenoid Valve controls air cylinder for back

Air Cylinder Solenoid Valve Black wire

+5V - Relay on

0V - Relay off

1K ohm

2.3K ohm

Arduino Mega pin 22 (PA0)

Eye LEDs

10K ohm

+5V

Gnd

Arduino Mega pin 24 (PA2)

Button

Head Rotate Servo Cntrl 🡪 Arduino Mega pin 11 (PWM PB5) Rest position: Servo at approx. 90 degree, head straight forward

Head Nod Servo Cntrl 🡪 Arduino Mega pin 12 (PWM PB6) Rest position: Servo at approx. 90 degree, head level

Mouth Servo Cntrl🡪 Arduino Mega pin 13 (PWM PB7) Rest position: Servo at approx. 110 degree , mouth closed

Arm Servo Pitch 🡪 Arduino Mega pin 46 (PWM PL3) Rest position: Servo at approx. 180 degree, arm hanging straight down (arm at pitch of 90 deg down). Range: 0 – 230 degrees

Arm Servo Roll 🡪 Arduino Mega pin 45 (PWM PL4) Rest position: Servo at approx. 120 degree, arm level (arm at 0 deg roll with respect to ground) Range: 120 – 240 degrees. Servo at 120+90= 210 degrees has shoulder rotated 90 degrees up)

Arm Servo Yaw 🡪 Arduino Mega pin 44 (PWM PL5) Rest position: Servo at approx. 90 degree, arm straight out (perpendicular to body ) Range: 45 – 180 degrees. Limits match what a typical human arm can do. Servo at 180 degrees is arm out to right (from the viewpoint of the prop itself)

Elbow Servo Pitch 🡪 Arduino Mega pin 2 (PWM PE4)

Eye LEDs 🡪 See circuit above

Button 🡪 See circuit above

MDFLY MP3 (AU5120/5121)Audio Player pins:

Pin 15 (RXD serial in) 🡪 Arduino pin 14 (TXD3 out serial pin)

pin 17 Right Audio Out -🡪 thru 1.8K ohm resistor to Prop Right Audio In (Disconnected when using Electret Mic to drive prop audio)  
pin 18 Left Audio Out -🡪 thru 1.8K ohm resistor to Prop Left Audio In (Disconnected when using Electret Mic to drive prop audio)

Pin 19 GND (RTN)

Pin 20 VCC 🡪 12volts

Modified Electret Microphone Amplifier - MAX9814 with Auto Gain Control (Adafruit ADA1713) connected to headphone mic:

Modification was to disable AGC by attaching the 9814 TH to its MICBIAS (short across the resistor between those pins). Also the Electret mic itself was removed and the headphones mic was connected in its place.

Pin Gnd -🡪 Gnd Arduino and battery

Pin Vdd 🡪 4.5V Battery

Pin Gain 🡪 4.5V Battery (sets gain to 40dB)

Pin Out 🡪 thru 1.8K + 10K ohm resistors to Prop Right/Left Audio In. The 10K reduces the amplified mic output to reduce feedback from the outside speaker to the mic.  
Pin AR – NC

Electret Microphone Amplifier - MAX9814 with Auto Gain Control (Adafruit ADA1713) from prop connected to headphone:

Pin Gnd -🡪 Gnd Arduino and battery

Pin Vdd 🡪 4.5V Battery

Pin Gain 🡪 4.5V Battery (sets gain to 40dB)

Pin Out 🡪 To HeadPhone  
Pin AR - NC

Adafruit TCA9548A I2C Switch (used to resolve I2C address conflicts for accessing BNO055s as these only allow two fixed I2C address strappings)

Vin 🡪 5V Arduino

Gnd 🡪 Gnd Arduino

SCL 🡪 Arduino pin 21 (SCL)

SDA 🡪 Arduino pin 20 (SDA)

RST 🡪 NC

A0,A1,A2 🡪 NC (results in switch ctrl I2C adrs of 0x70)

Adafruit BNO055 board Absolute Orientation Sensors: One sensor is used on Head, one on Mouth

Vin 🡪 5V Arduino

3VO 🡪 NC

Gnd 🡪 Gnd Arduino

SCL 🡪 I2C Switch (SC0)

SDA 🡪 I2C Switch (SD0)

RST 🡪 NC

INT 🡪 NC

ADR 🡪 BNO055 board 3V for Head BNo055 for 0x29 I2C ID, Open for Mouth BNO055 0x28 ID

PSO, PS1 🡪 NC

Adafruit BNO055 board Absolute Orientation Sensors: One sensor is used on arm, one on forearm

Vin 🡪 5V Arduino

3VO 🡪 NC

Gnd 🡪 Gnd Arduino

SCL 🡪 I2C Switch (SC1)

SDA 🡪 I2C Switch (SD1)

RST 🡪 NC

INT 🡪 NC

ADR 🡪 BNO055 board 3V for Arm BNo055 for 0x29 I2C ID, Open for Forearm BNO055 0x28 ID

PSO, PS1 🡪 NC

Adafruit Micro SD Card Breakout Board – Used to store data, prop values on an SD card

5V pin 🡪 5V Arduino

GND 🡪 GND Arduino

CLK 🡪 SCK Arduino

DO 🡪 MISO Arduino

DI 🡪 MOSI Arduino

CS 🡪 SS Arduino