SETUP

DEFINE STUFF
- SERIAL BEGIN
- DESIDERED ANGLE X, Y
- SERVO OFFSET X, Y
- POSITION OF SERVO TROUGH THE STARTUP FUNCTION
- SERVO STARTUP MOVING STEP
- SERVO GEAR TO TVC RATIO
- I/O ATTACHMENTS
- PID CONSTANTS

STARTUP ()
- SERVO MOVEMENT TEST
- LED BLINK RASP.
- LED BLINK MAGENTA
- TVC CIRCLE MOVEMENT
- LED BLINK YELLOW
- LED BLINK RED } x5
- LED BLINK BLUE }
- MUSIC

GYRO/BARO STARTUP

CALIBRATE GYRO

RADIOSTARTUP

OFFSET BARO

SD CARD STARTUP

SD WRITE → STARTUP INFO → (1 HZ)
- GYRO
- Temperature
- PRESSURE / ALTITUDE
- SD STATE
- LOOP STATE

STATE 0 → ROCKET ON LAUNCHPAD

LAUNCHREADY ()
- STATE == 0
- SERIAL "ANDROMEDA ARMED!"
- SERIAL "ANDROMEDA HAS CALIBRATED EVERY SENSOR! \n READY TO LAUNCH"
- LED GREEN

LAUNCHDETECT ()
- GYRO UPDATE
- IF STATE = 0 && ACCEL. > 1,6 && LAUNCHPADSECURITYSYSTEM=TRUE → STATE ++
- ELSE

LAUNCHPAD_SEC_SYSTEM = TRUE
- IF 35 > TEMP > 0 & IF PAS > 800 & IF ACCX,Y,Z < 0.5 & LAUNCHPAD COMM = TRUE

RADIOCOMMUNICATION ()
- IGNITION SIGNAL = TRUE
- MICROPH. IGNITION SIGNAL = TRUE
- ACCELERATION > 1.6
- VOLTAGE > 7

STATE 1 → ASCENDING + COASTING

BURNOUT DETECT ()
- IF STATE == 1 && ACCEL. ≤ 0.2
  - STATE ++
  - SERIAL PRINT 'BURNOUT DETECTED'
  - DIGITALWRITE MOSFET PYRO, HIGH
- ELSE

FLIGHTSECURITY SYSTEM ()
- IF ERRORX > 15 OR ERRORY > 15 OR VOLTAGE < 5

ORIENTATION_ROT_MATRIX ()
- PREV.GYRO = RADGYRO
- RADGYRO = GYRO · π/180
- DELTAGYRO = RADGYRO − PREV GYRO
- LASTORIENTATIONX = NEWORIENTATIONX
- LASTORIENTATIONY = NEWORIENTATIONY
- LASTORIENTATIONZ = NEWORIENTATIONZ
- KALMAN FILTER
- XMATRIX → $m_1 = \cos\Delta GYROZ \cdot \cos\Delta GYROY$
  $m_2 = (\sin\Delta GYROZ \cdot -1) \cdot \cos\Delta GYROX + \cos\Delta GYROZ \cdot \sin\Delta GYROY \cdot \sin\Delta GYROX$
  $m_3 = \sin\Delta GYROZ \cdot \sin\Delta GYROX + \cos\Delta GYROZ \cdot \sin\Delta GYROY \cdot \sin\Delta GYROX$
- YMATRIX → $m_4 = \sin\Delta GYROZ \cdot \cos\Delta GYROY$
  $m_5 = (\cos\Delta GYROZ \cdot \cos\Delta GYROX \cdot \sin\Delta GYROZ) \cdot \sin\Delta GYROY \cdot \sin\Delta GYROX$
  $m_6 = (\sin\Delta GYROZ \cdot -1) \cdot \sin\Delta GYROX + \cos\Delta GYROZ \cdot \sin\Delta GYROY \cdot \sin\Delta GYROX$
- ZMATRIX → $m_7 = (\sin\Delta GYROY) \cdot -1$
  $m_8 = \cos\Delta GYROY \cdot \sin\Delta GYROX$
  $m_9 = \cos\Delta GYROY \cdot \cos\Delta GYROX$
- NEWORIENTATIONX = (LASTORIENTATIONX · m1) + (LASTORIENTATIONY · m2) + (LASTORIENTATIONZ · m3)
- NEWORIENTATIONY = (LASTORIENTATIONX · m4) + (LASTORIENTATIONY · m5) + (LASTORIENTATIONZ · m6)
- NEWORIENTATIONZ = (LASTORIENTATIONX · m7) + (LASTORIENTATIONY · m8) + (LASTORIENTATIONZ · m9)
- OUTPUTX = LASTORIENTATIONX · 60
- OUTPUTY = LASTORIENTATIONY · −60

APOGEE DETECTION + FIRST PARACHUTE EJECTION

- ANGLE X = ARC SIN (NEWORIENTATION x) $\cdot \frac{-180}{\pi}$
- ANGLE Y = ARC SIN (NEWORIENTATION y) $\cdot \frac{180}{\pi}$
- ANGLE Z = ARC SIN (NEWORIENTATION z) $\cdot \frac{180}{\pi}$

PIDCOMPUTE()

- LASTERRORX = NEWERRORX
- LASTERRORY = NEWERRORY
- LASTERRORz = NEWERRORZ
- NEWERRORX = ANGLE X - DESIRED ANGLE X
- NEWERRORY = ANGLEY - DESIRED ANGLE Y
- Propor. → PIDX_P = NEWERRORx · KP
  PIDY_P = NEWERRORY · KP
- INTEGRAL → $PIDX\_i = ki \cdot \left[PIDX\_i + \left(\frac{NEWERRORX}{\Delta t} \right) \right]$

  $PIDY\_i = ki \cdot \left[PIDY\_i + \left(\frac{NEWERRORY}{\Delta t} \right) \right]$
- DERIVATIVE → $PIDX\_D = Kd \cdot \frac{(NEWERRORX - LASTERRORX)}{\Delta t}$

  $PIDY\_D = Kd \cdot \frac{(NEWERRORY - LASTERRORY)}{\Delta t}$
- SUM_PID → PIDX = PIDX_P + PIDX_i + PIDX_D
  PIDY = PIDY_P + PIDY_i + PIDY_D
- SERVO INPUT X → (PIDX · SERVOGEARTOTVCRATIO) + SERVOX OFFSET
- SERVO INPUT Y → (PIDY · SERVOGEARTOTVCRATIO) + SERVOY OFFSET
- SERVOWRITE (SERVO INPUT X)
- SERVO WRITE (SERVO INPUT Y)
- DATA DUMP () → · SERIALPRINT → · PITCH
  · ROLL
  · YAW
  · ACC X, Y, Z
  · CURRENT STATE
  · ALTITUDE
  · PRESSURE
  · MILLIS
  · TVC ANGLE X, Y, Z
  · VOLTAGE

  ON FLASH MEMORY
- RADIO_COMMUNICATION()
- FILE DATAFILE = SD.OPEN("FLIGHT_NUMBER_.TXT, FILE WRITE)

STATE 2

DATADUMP () — — — — — — — ↗

RECOVERY_SECURITY SYSTEM () → IF CURRENT_ALT < (MAX ALTITUDE - START ALTITUDE) - 7
OR
TIME FROM MAX ALTITUDE - MILLIS ≥ 6
→ PYRO 1 = HIGH

SAVE PRIVATE RYAN ()
→ IF CURRENTALT < STARTALTITUDE + 10 → PYRO 2 EJECT

LED AND MUSIC - PARTY MODE()