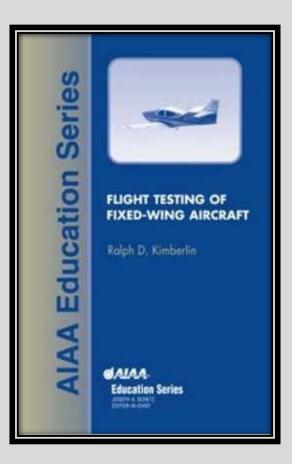
# Flight Testing & Checklists

Phil Baldwin 2/16/2018

To Do List 1) Make to do list V 2) Check off first thing on to do list V 3) Realize you've already accomptished 2 things / 4) Reward yourself with nap (in prograss)

# Additional Reference – *Flight Testing of Fixed-Wing Aircraft,* Ralph Kimberlin

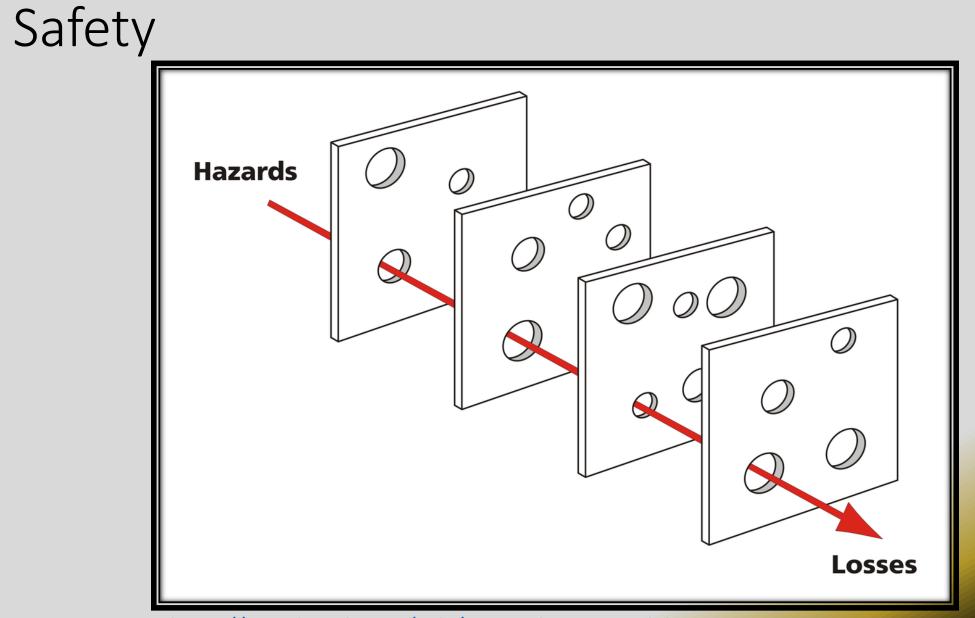


## Topics

- Safety
- Operating Limitations
- Regulations
- Briefing
- Pre-Flight Checklist
- In-Flight Checklist
- Post-Flight Checklist
- Debriefing

# Safety

- Maintain safety for EVERYONE involved
  - Pilot
  - Ground crew
  - Spectators
  - Bystanders
- Set up safety procedures and follow them
- No one person is in charge of safety during testing: everyone must be aware of what is happening
- "Swiss cheese" model
  - Several seemingly small events lead to major loss

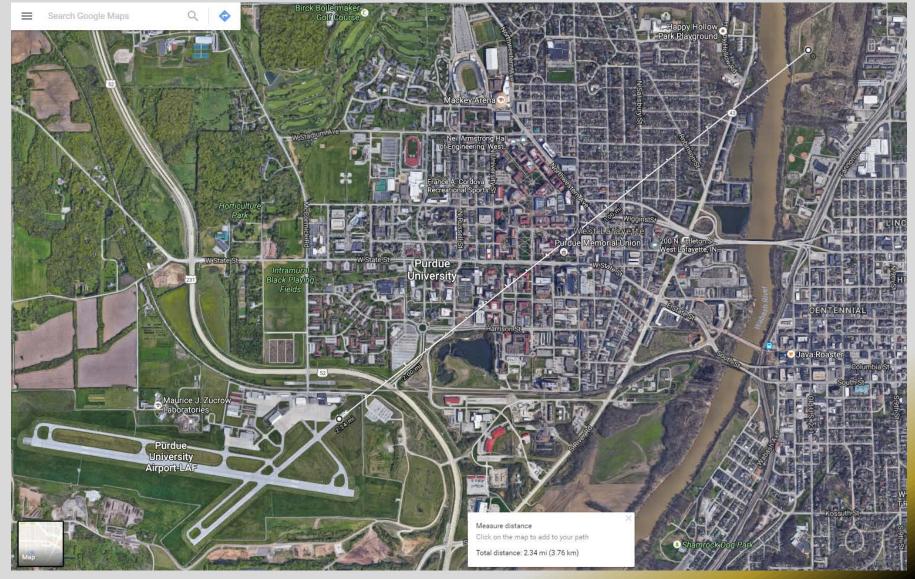


https://en.wikipedia.org/wiki/Swiss\_cheese\_model

# Safety

- Maintain situational awareness
  - Other people may be flying with you
  - An extra set of eyes is always helpful
- <u>AMA Safety Code</u>
- Flight Test Safety's Best Practices
- Absolutely must maintain sufficient clearance from manned aircraft
  - For UAS: FAA-mandated maximum of 400 ft AGL
  - Example: at the local AMA field, 400' AGL puts only 300 feet in between our aircraft and aircraft on glideslope for RW 23 at KLAF
    - If the manned aircraft is 1° below glideslope, that clearance is down to about 100 feet

## Safety



8

### **Operating Limitations**

- Intrinsically related to the safety of the operation
- Often driven by weather or other physical factors
  - Cloud ceiling
  - Temperature limits
    - Can be an aircraft or a pilot limitation
  - Wind speed/direction
  - Visibility
  - Battery voltage
  - Did you bring a tool kit?
- Develop a GO/NO-GO decision tree for testing based on your operating limitations

## Regulations

- Federal
  - FAR Part 107
- State or local legislation
- Community-Based Organization
  - Academy of Model Aeronautics
    - Provides insurance and other services
- Local club
  - Often have their own safety rules for specific sites
- Land owner



### Procedures

- Step-by-step of each segment of testing, from beginning to end
  - One action per step, e.g.
    - 1. Ensure prop arc clear
    - 2. Insert safety plug
    - 3. Verify correct ESC tone output (verify # battery cells) INSTEAD OF
    - 1. Power up propulsion system
  - Checklist format is nice
- If you have one person create procedures, have another verify and offer corrections/improvements
- Likewise, have a second person verify all checklist items during test execution

### Procedures

- Pre-flight procedures ensure you will be ready to fly at the field
  - There will be snow on the ground (in Indiana anyway...) at some point
- Procedures for flight are broken down by maneuver
  - Traditionally called "cards" as the pilot would have them on a kneeboard in the aircraft
  - For UAS flight testing:
    - All or most data acquired on-board
    - Have a teammate tell the pilot what maneuvers are to be flown and with what parameters
      - Airspeed tolerances, altitude tolerances, power settings, etc.
      - Live data on the ground makes this easy
    - Once autopilot control gains are known, may be able to automate some tests
  - Pilot input is valuable to assessing the performance

## Briefing



# Briefing

- Discuss with team what will happen during flight
- Build list of extra items to take that are not already on a "Things to take flying" checklist
- Assign jobs
  - Video
  - Hand-written notes
  - Spotter
  - Etc.
- Walk through checklists

### Example Checklist

- Small GA aircraft
- IC engine not all steps applicable
- Notice breakdown of steps
  - Line-by-line
  - Single item per line
- Generally verbalize "Preflight checklist complete" after completing that section
  - "Before start checklist complete"... etc.

|                               | NAMES OF TAXABLE PARTY AND ADDRESS OF TAXABLE PARTY. | iper PA28-16                 | · · · · · · · · · · · · · · · · · · · |               |              |
|-------------------------------|--|------------------------------|---------------------------------------|---------------|--------------|
| PREFLIGHT<br>CERT/DOC         | SHI DOADD  | WHILE TAXIING<br>BRAKES      | CUECK                                 | POWER         | 2300 RCM     |
| CERT/DOC                      | ON BOARD   | BRAKES                       | CHECK                                 |               | AS REQUIRE 2 |
| Mx LOG                        |  | D.G                          | CHECK                                 | TURE          | LEAN AS REC  |
| TACH/HOBBS                    |  | T.C.                         | CHECK                                 | SL SEL        | CYCLE @ 15   |
| PARKING BRAKE                 |  | VOR                          | and an and a second                   | IN SCENT      |              |
| CONTROL LOCK                  |  |                              |                                       | ANTI IDE      | AS REC.      |
|                               | LEAN   | GROUND CHECK                 |                                       | CARR HEAT     | AS REQUIRED  |
| MIXTURE                       |  | DDAVEC                       | SET                                   | 2.74          | RECORDED     |
| CB'S                          |  |                              |                                       |               |              |
| ALT STATIC AIR<br>BATT MASTER |  | ENGINE INST                  | CHECK                                 | FLIEL SEL     | PROPER TANK  |
|                               |  | MACHIEM                      | CHECK                                 |               |              |
| FUEL QUANTITY                 |  | VACUUM                       | TEST                                  | REFORE LANDIN | 9            |
| ANNUNCIATORS                  |  | ALTERNATOR<br>MAG CHECK      | MAX DROP 175                          | ADD BRIEF     | COMPLETE     |
| LIGHTS                        |  |                              | MAY DIFF 50                           | MIXTURE       | FULL RICH    |
| PITOT HEAT                    |  | CADR HEAT                    | (1) -800                              | CARB HEAT     | ASREQUINEL   |
| BATT MASTER                   |  | TUDOTTLE                     | IDIE                                  | FLIFI PUMP    |              |
| FLAPS                         |  |                              | OFF                                   | AUTO PILOT    | OF           |
| EXTERION                      | USE POH  | THROTTLE                     | 900.1000                              | AUPSDEED      | 65 - 75 KIAS |
| THE OF STINC                  |  | THROTTLE                     |                                       | AINOPELO      |              |
| BEFORE ST. ATING              |  | INCLORE TAKEOFF              |                                       | AFTER LANDING |              |
| BRAKES                        |  | PADIOS                       | SET                                   | FLAPS         | U            |
| FLAPS                         | DEMOVED  | DG                           | CHECK                                 | TRANSPONDER.  | STB          |
| CHOCKS                        | REMOVED  | ANNUNCIATORS                 | TEST                                  | CARB HEAT     | OFI          |
| AVIONICS MOTR                 |  | MITTIDE                      | FULL RICH                             | FUEL PUMP     | OF           |
| AUTO PILC                     | Urr  | FIEC FUEL PLIMP              | ON                                    | BEACON        | REMAINS OF   |
| PAX BRIEF                     | COMPLETED  | ENICINE INCT                 | CHECK                                 | FXTLIGHTS     | AS REQUIRE   |
| SEATS/SEAT BELT               | ADJUSTED   | CARB HEAT                    | OFF                                   | DITOT HEAT    | OF           |
| ALL ELECTRICAL                | OFF  | CARB HEAT                    | IN                                    | PHOTHER       | LEAN AS REQ  |
| CARB HEAT                     | UPP TANK   | CEAT DELTS                   | FASTENED                              | ISHUTDOWN     |              |
| FUEL SELECTOR                 | FULLEST TANK   | SEAT BELTS                   | LATCHED                               | PARKING BRAKE | AS REQUIRE   |
|                               |  | DOOR/WINDOWS                 | SET                                   | PARAMICS MSTR | OF           |
| ENGINE START                  | DICH   |                              | SET FOR TO                            | ELECTRICAL    | OF           |
| MIXTURE                       | RICH   | TRIM.                        | SETFOR T.O.                           | THROTTLE      | 800-10       |
| THROTTLE                      | OPEN 1/4   | CONTROLS                     | FREE/CORRECT                          | THROTTLE      | CROUND CH    |
| BATT MASTER/ALT               | ON   | DED DDIEE                    | COMPLETE                              | MAGNETO.      | 1200 ( 10 st |
| PRIMER                        |  | PARKING BRAKE<br>TRANSPONDER |                                       | THROTTLE      |              |
| BEACON                        | ON   | TRANSPONDER                  | ALI                                   | MIXTURE       |              |
| ELEC. FUEL PUMP               | ON   | EXT LIGHTS                   | ALL ON                                | THROTTLE      | IDI          |
| FUEL PRESS                    |  |                              | CHK ON RWY                            | MAGNETOS      |              |
| AREA                          | CLEAR  |                              |                                       | BEACON        |              |
| STARTER                       | ENGAGE   | TAKEOFF                      |                                       | FLIGHT PLAN   |              |
| THROTTLE                      |  | TUDOTTIE                     | FULL OPEN                             | BATT MASTER/A |              |
| OIL PRESSURE                  |  | ENGINE INST                  | CHECK                                 | TACH/HOBBS    | RECO         |
| ELEC. FUEL PUM P.             |  | DOTATE                       | 52 KIAS                               | LDG GEAR      | CHO          |
| FUEL PRESS                    |  | INITIAL CLIMB                |                                       | PARKING BRAKE | ERELEA       |
| AVIONICS MSTR                 |  | TRANSITION Vy                | 79 KIAS                               | 5             |              |
| PRE-TAXI                      |  | Thomas Thomas and            |                                       | IKLAF FREQUEN | ICIES        |
| RADIOS                        | SET  | ENROUTE CLIMB                |                                       | ATIS          |              |
| TRANSPONDER                   |  |                              | 76 - 87 KIAS                          | TOWER         |              |
| CLOCK                         |  | MIXTURE                      | 12 PEOUIRET                           | GROUND        |              |
|                               | TEDO   | MIXTURE                      | AS REQUIRED                           | J GILCONG.    |              |
| AIRSPEED                      | ZERU   | FUEL PUMP                    |                                       |               |              |
| ATTITUDE INDICATO             | RERECT   | EXT LIGHTS                   | AS REQUIRED                           |               |              |
| ALTIMETER                     | SET  |                              |                                       | UNICOM        |              |
| D.G                           | SEL  |                              |                                       |               |              |

# Example Checklist #2



### **BEFORE STARTING**

| • INS 3 CKD/ALIGN                    |
|--------------------------------------|
| 02 & INTERPHONE ON 100% CKD/BOOM     |
| STATIC SOURCE SELNORMAL              |
| ANTI-SKIDON                          |
| BODY GEAR STEERINGARM                |
| AUTO BRAKELDG-OFF                    |
| COMPASS CONTROLLERS                  |
| EMERGENCY LIGHTSARMED                |
| SEAT BELT, NO SMOKEON                |
| ALT FLAPSOFF                         |
| STALL WARNINGTEST/NORMAL             |
| MACH A/STEST                         |
| NACELLE & WING ANTI-ICEOFF           |
| PROBE HEAT PITOTS ONLY               |
| WINDOW HEATON                        |
| EXTERIOR LIGHTS                      |
| RADIO INS SWITCH                     |
| NAV RADIOS/AUTO FLT PANELCKD/SET     |
| GROUND PROXTEST                      |
| FLT MODE ANNUNCIATORSTEST            |
| FLT INSTR/FLT DIR/ALTS CKD/TEST/SET  |
| RADIO ALTTEST                        |
| RESERVE BRAKECKD/CLOSED              |
| LDG GEAR                             |
| SPEED BRAKE                          |
| THROTTLES/START LEVERS CLOSED/CUTOFF |
| PARK BRAKESET/PRESS CKD              |
| SELCAL/RADAR & TRANSPONDER SET/STBY  |
| ELECTRICAL PANEL                     |
| OIL QUANTITY                         |
| FUEL QTY/GROSS WTLBS/SET             |
| FIRE WARNINGTEST                     |
| • WT & BALANCE                       |
| ANTI SKID GROUND MODE                |
| FLT RECORDERTEST/SET                 |
|                                      |

### PRIOR TO PUSH BACK/START

| · INS.                   |                               |
|--------------------------|-------------------------------|
| <ul> <li>BEAG</li> </ul> | CONON                         |
| · HYDI                   | RAULICS#1 ADP/#4 ELEC PUMP ON |
| • DOO                    | RS CKD/LTS OUT                |
| . EVAC                   | SLIDES LATCHED & AUTO         |
| <ul> <li>FUEL</li> </ul> | BOOST PUMPSON                 |
|                          | REQUIRED AT TRANSIT STATIONS  |

### **BEFORE TAXI**

| START ARM SWITCH           | OFF     |
|----------------------------|---------|
| ELECTRICAL POWER           | SET     |
| APU BLEED                  | CLOSE   |
| HYDRAULICSAUTO/NORMAL/     | QTY CKD |
| SEAT BELTS & SHLDR HARNESS | ON      |
| GEAR & NOSE STEER PINS     | VED/CKD |
| GROUND EQUIPMENTDISCONNEC  | T/CLEAR |

### TAXI CHECK

| NACELLE ANTI-ICE                 | SET                         |
|----------------------------------|-----------------------------|
| FLAPS //                         | <b>_GREEN LIGHTS/DETENT</b> |
| CONTROLS                         | CKD                         |
| STAB & TRIM                      | THREE SET                   |
| TAKE OFF DATA                    | CKD/SET                     |
| <b>FLT &amp; NAV INSTRUMENTS</b> | X-CKD/SET                   |
|                                  | 'SET                        |
| APU                              |                             |
|                                  | NORMAL                      |
|                                  | OFF                         |
|                                  |                             |
| FUEL SYSSET                      | /MAIN BOOST PUMPS ON        |
|                                  | FLT START                   |
| ANNUNCIATOR LIGHTS .             | CKD                         |
| AIR COND.                        |                             |
|                                  |                             |

### **BEFORE TAKE OFF**

| LANDING & STROBE LIGHTS |    |
|-------------------------|----|
| TRANSPONDER             |    |
| AUTO BRAKE              |    |
| BODY GEAR DISA          | RM |

### CLIMB

| LANDING GEAR                 | UP & OFF    |
|------------------------------|-------------|
| FLAPS                        | LIGHTS OUT  |
| PROBE HEAT                   | ON          |
| NO SMOKE                     | OFF         |
| IGNITION                     | SET         |
| FUEL SCHED                   | SET         |
| AIR COND                     | SET         |
| TRANSITION LEVEL CHECK/OR/18 | 8,000 FT    |
| LOGO & LANDING LTS           | OFF/10,000' |
| ALTIMETERS                   | RESET       |

### DESCENT

| IGNITIONFLT START                |
|----------------------------------|
| SEATBELTS/SHLDR HARNESS & SIGNON |
| FLT MODE ANNUNCIATORSTEST        |
| GROUND PROXTEST                  |
| RADIO ALTTEST/2000               |
| RADIO INS SWITCH RADIO           |
| PRESSURIZATIONSET                |
| HYDRAULIC SYSTEMS CKD/NORMAL     |
| FUEL MANAGEMENTSET FOR LANDING   |

### FAA APPROVED 9/1/77

| 18,000 FT/OR/TRANSITION | LEVEL CHECK |
|-------------------------|-------------|
| ALTIMETERS              |             |
| LANDING & LOGO LIGHTS   | ON/10,000'  |
|                         | 1           |

### APPROACH

| FLAPS         | 1    | GREEN LIGHT/DETENT    |
|---------------|------|-----------------------|
| ADF/VOR SWIT  | CHES | SET                   |
|               |      | MDA/DH SET            |
| NACELLE ANTI- | ICE  | SET                   |
| FUEL SYS      | M    | AIN BOOST ON/HEAT OFF |
| NO SMOKE      |      | ON                    |

### **BEFORE LANDING**

| LANDING GEAR               | . DOWN-GREEN LIGHT |
|----------------------------|--------------------|
| AUTO BRAKE                 | SET/LT OUT         |
| SPEED BRAKE                |                    |
|                            |                    |
| FLAPS<br>FLAG SCAN OM-500' |                    |

### AFTER LANDING

| BODY GEAR STEERING      | RMED   |
|-------------------------|--------|
| SPEED BRAKE DOWN/D      | ETENT  |
| FLAPSUP/L1              | SOUT   |
| LDG LTS & STROBE LIGHTS | SET    |
| IGNITION                |        |
| RADAR & TRANSPONDER     |        |
| STABILIZER TRIM         | .5 SET |
| BRAKE TEMP & HYDRAULICS | CKD    |
| ANTI-SKID GROUND MODE   |        |
| UPPER DECK & CARGO HEAT | OFF    |
| FIRE WARNING            | .TEST  |
| APU                     | START  |
|                         |        |

### PARKING

| PARKING BRAKESET               |
|--------------------------------|
| APU OR EXTERNAL POWERCONNECTED |
| START LEVERSOFF                |
| SEAT BELTOFF                   |
| PROBE HEAT/WINDOW HEATOFF      |
| EXTERIOR LIGHTS                |
| EMERGENCY EXIT LIGHTS          |
| INSRECORD 3/OFF                |
| HYDRAULIC AIR PUMPSOFF         |
| WT & BAL POWER SWON            |
| FUEL BOOST PUMPS               |
| FUEL RESERVE VALVES            |
|                                |
| STANDBY POWER SWITCHOFF        |
| RADIO MASTERSSE                |
| FOR TERMINATING FLIGHTS        |
| OXYGEN VALVECLOSED             |
| APUSE                          |
| BATTERY                        |
|                                |
|                                |

### Pre-Flight Checklists

Why do they exist?

- Get team and aircraft ready to fly
- Make sure nothing is missing...
- Ensure systems functioning nominally



### Pre-Flight Checklists

- Before leaving base (Armstrong Hall, etc.)
  - Take flight box
  - Take plane
- Upon arrival at flight field
  - Unload components
- Before powering up
  - Visual inspection
  - Control surfaces
- Powering up
  - Plug in battery

### Pre-Flight Checklists

### **Exercise:**

- As teams, create a first draft for your team's pre-flight checklist (only pre-flight right now)
  - Google docs is fine
  - Be specific!
- 5 minutes to work, then quick 1-minute presentation from each team
- Discussion and thoughts from other teams/coaches

### <u>Timer</u>

Why do they exist?

- Perform the tasks you want to perform in the way you want them performed
- Remove guess work in a fast-paced phases of flight
  - "Do I flip the switch now? I thought I was supposed to do X first"
- Ensure some performance value is being met
  - E.g. every 5 minutes, check battery voltage/% capacity remaining
- Make sure aircraft is in the correct configuration...

Example of a missed checklist item...

- Climb out Manual Mode
- Climb out Auto Mode
- Cruise Manual Mode
- Cruise Auto Mode
- Before Landing Manual Mode
- Before Landing Auto Mode

### **Exercise:**

- As teams, create a first draft for your team's in-flight checklist (only in-flight right now)
  - Google docs is fine (new tab from earlier one works well)
  - Be specific!
- 5 minutes to work, then quick 1-minute presentation from each team
- Discussion and thoughts from other teams/coaches

### <u>Timer</u>

### Post-Flight Checklists

Why do they exist?

- Ensure safety of team
- Ensure safety of spectators
- Prepare aircraft for disassembly/transport/another flight



### Post-Flight Checklists

- Disarm System
- Safe System
- Remove battery
- Download logs
- Secure components



### Post-Flight Checklists

### **Exercise:**

- As teams, create a first draft for your team's in-flight checklist (only post-flight right now)
  - Google docs is fine (new tab from earlier one works well)
  - Be specific!
- 5 minutes to work, then quick 1-minute presentation from each team
- Discussion and thoughts from other teams/coaches

### <u>Timer</u>

## Debriefing

- Wrap-up of what went well
  - And what did not
- Assign next tasks (hopefully not repairs)





# One more example checklist

### **Emergency Procedures**

- Not much to be done for a lot of inflight emergencies for R/C aircraft
  - But regaining control from an erroneous autopilot is possible!
- Crash debris recovery procedures should be put in place
  - LiPo batteries need monitored
  - Motors may still spin

|                             | FOOTNOV                | PROCEDURES  |  |
|-----------------------------|------------------------|---|--|
| EM                          | ERGENCY                | THE POWER LOSS IN FLIGHT  |  |
| THE FIRE DURING S           | ART                    | 1. FUEL SELECTOR SWITCH TANK  | (S   |
| GINETICE                    | CONTINUE CRANKING      | 2. ELEC. FUEL PUMP ON   | G  |
| A ADACT LIDE                | CUTUFF                 | 3. MIXTURE RICH   | No.  |
| THROTTLE.                   | FULL OPEN              |   |  |
| ELECTRIC FUEL PUMP          | P. OFF                 |   | ED   |
| FUEL SELECTOR               | OFF                    |   |  |
| ABANDON IF FIRE CO          | NTINUES                | 6. ENGINE GAUGES  | OSS  |
| TOTAL CALLINES              |                        | in the first of shock fuel t  | ank  |
| It annunciator light illumi | nated:                 | If no fuel pressure is indicated, check fuel t  | ontaining  |
| AMMETER.                    | VERIEV INOP ALT        | If no fuel pressure is indicated, cheer a tank c selector position to be sure it is on a tank c | , and a start of the start of t |
| . AMME1ER                   | VERI T INOT THE        | fuel.   |  |
| f ammeter shows zero:       |                        | i secondi   |  |
| ALT SWITCH                  | OFF                    | When power is restored:   |  |
| PERLICE ELECTRICA           | LLOAD                  | 7. CARB HEATOFF   |  |
| ALT CE                      | CHECK and RESET AS     | 8. ELEC FUEL PUMP OFF   |  |
|                             | REQUIRED               | I I I I I I I I I I I I I I I I I I I   |  |
| 5. AL SWITCH                | ON                     | When power is NOT restored:   |  |
| and the Assessment          |                        | 9. AIRSPEED   | G  |
| If power is OT restored:    |                        | 10. PREPARE FOR POWER OFF CARDIN  | 0  |
| 6. ALT SWITCH               | OF F                   |   |  |
|                             |                        | POWER OFF LANDING   |  |
| If alternator output canno  | t be restored, reduce  | 1. LOCATE SUITABLE FIELD  |  |
| electrical load and land a  | is soon as practical.  | 2. ESTABLISH SPIRAL PATTERN<br>3. 1000FT ABOVE FIELD AT DOWNWIND                                | POSITION   |
|                             |                        | FOR NORMAL LANDING APPROACH   | ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,  |
| ELECTRICAL OVERLO           | 6D                     | 4. WHEN FIELD CAN EASILY BE REACH   | ED SLOW  |
| 1. ALT SWITCH               | ON                     | TO 63 KIAS  | 20,02011   |
| 2. BATT SWITCH              | OFF                    | 5. TOUCHDOWN SHOULD BE MADE AT  | THE  |
| If alternator loads are re  | ducad:                 | LOWEST POSSIBLE AIRSPEED WITH   |  |
| alternator loads are re     | REDUCE TO MINIMUM      | FIRE IN FLIGHT  |  |
| 4. LAND AS SOON AS          | PRACTICAL              | SOURCE OF FIRE CHECK  |  |
|                             |                        |   |  |
| If alternator loads are no  |                        | Electrical fire (smoke in cabin)  |  |
| 5. ALT SWITCH               |                        | 1. MASTER SWITCH OFF<br>2. VENTSOPEN  |  |
| 6. BATT SWITCH              | POSSIBLE. ANTICIPATE   | 3. CABIN HEAT OFF   |  |
| COMPLETE ELECT              |                        | 4. LAND AS SOON AS PRACTICAL  |  |
| V-SPEEDS                    | NICALITALONE           | A CAND AS SOON AS PRACTICAL   |  |
| BEST GLIDE                  | 73 KIAS                | Engine Fire   |  |
| Vso                         | 44 KIAS                | 1. FUEL SELECTOR OFF  |  |
| Vs1                         | 50 KIAS                | 2. THROTTLE. CLOSED   |  |
| Vr                          | 45-55 KIAS             | IS. MIXTURE   | F  |
| Vx                          | 63 KIAS                | 14. FUEL PUMP   |  |
| Vy<br>Va                    | 79 KIAS<br>88-111 KIAS | D. HEALER   | Contraction of the owner of  |
| Va<br>Vfe                   | 103 KIAS               | ID. DEFROSTER   |  |
| Vno                         | 126 KIAS               | 7. PROCEED WITH POWER OFF LANDI   | NG   |
| Vne                         | 160 KIAS               | ***This checklist is for training purpose   | a calul  |
| Enroute Climb               | 87 KIAS                | ***Please refer to the Dout   | s only   |
| Demonstrated X-wind         | 17 KIAS                | ***Please refer to the POH for more con<br>information  | plete  |

### Mission Planner's Pre-Flight Feature

| Quick  | Actions      | PreFlight     | Gauges   | Status   | Servo | Telemetry Logs | DataFlash Logs | Scripts | Messages |
|--------|--------------|---------------|----------|----------|-------|----------------|----------------|---------|----------|
|        |              |               |          |          |       |                |                |         | Edit     |
| Veni   | fy GPS       |               | 0 >=     | 3        |       |                |                |         |          |
|        | ,            |               | <u> </u> | <u> </u> |       |                |                |         |          |
| Gps    | Sat Count    |               | 0 Sal    | 3        |       |                |                |         |          |
| Teler  | metry Sign   | al            | 0%       |          |       |                |                |         |          |
| Batte  | ay Level     |               | 0 V      |          |       |                |                |         |          |
| Mode   | e            |               | Unkr     | nown     |       |                |                |         |          |
| Chec   | k Altitude:  |               | 0 < 5    | m        |       | <b>V</b>       |                |         |          |
| Tail a | and wings    | secured?      |          |          |       |                |                |         |          |
| All se | ervos respo  | ond to input  | ?        |          |       |                |                |         |          |
| All se | ervos respo  | ond to pitch  |          |          |       |                |                |         |          |
| Cent   | er of gravit | ty at indicat | ed       |          |       |                |                |         |          |
| Serv   | o linkages   | are secure    | ?        |          |       |                |                |         |          |
| Came   | era is on a  | nd ready to   | fly?     |          |       |                |                |         |          |
|        |              |               |          |          |       |                |                |         |          |

# Mission Planner's Pre-Flight Feature

- Very customizable add any parameter and trigger level
  - Battery voltage
  - % capacity remaining
  - Geofence
  - Etc.
- Add items that are not inherently part of the Pixhawk
- Add as many lines as you want

| PreFlight CheckListEditor |         | and the second s |  |     |
|---------------------------|---------|--|--|-----|
| + Save                    |         |  |  |     |
| Field Comparison          |         | Desciption / Value   | Color True Color False   |     |
| gpsstatus 🔹 GTEQ 🔻        | 3.00 ≑  | Veryify GPS  | Greer 🔻 Red 🔻  | •   |
|                           |         | {value} >= 3   |  |     |
| satcount 🔹 GTEQ 🔻         | 5.00 ≑  | Gps Sat Count  | Greer 🔻 Red 🔻  | • • |
|                           |         | {value} Sats   |  |     |
| linkqualitygcs 🗾 GT 👻     | 95.00 🔶 | Telemetry Signal   | Greer 🔻 Red 🝷  | • • |
|                           |         | {value}%   |  |     |
| battery_voltage 🔻 GT 🔻    | 22.00 🚖 | Battery Level  | Greer 🔻 Red 🔻  |     |
|                           |         | {value} V  |  |     |
| mode - NONE -             | 0.00 🚖  | Mode   | White 🔻 White 🔻  | • • |
|                           |         | {value}  |  |     |
| alt - LT -                | 5.00 🚖  | Check Altitude   | White 🔻 White 🕶  | •   |
|                           |         | {value} < 5m   |  |     |
| roll - NONE -             | 0.00 🔶  | Tail and wings secured?  | White 🔻 White 🝷  |     |
|                           |         |  |  |     |
| roll - NONE -             | 0.00 🔶  | All servos respond to input?   | White 👻 White 👻  |     |
|                           |         |  |  |     |
| roll - NONE -             | 0.00 🔶  | All servos respond to pitch and roll?  | White 🔻 White 🔻  |     |
| none                      | •.••    |  |  |     |
| roll - NONE -             | 0.00 ≑  | Center of gravity at indicated point?  | White 🔻 White 🔻  |     |
|                           | 0.00    |  | Winder Provide |     |
|                           | 0.00 🚔  | Servo linkages are secure?   | White - White -  |     |
| roll • NONE •             | 0.00 ≑  |  | White Vhite  |     |
|                           |         |  | 340.7  |     |
| roll • NONE •             | 0.00 ≑  | Camera is on and ready to fly?   | White 👻 White 👻  | + - |
|                           |         |  |  |     |

### Questions?