Development of a Flight Test Program for a Homebuilt Zenith STOL CH 701

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By

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Development of a Flight Test Program for a Homebuilt Zenith STOL CH 701

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The objective of this senior project is to prepare a phase I flight test program for a homebuilt Zenith CH 701 kit aircraft. The CH 701 is a small, short takeoff and landing experimental aircraft. A team including several Cal Poly students helped to construct the airframe and avionics of a 701 during the 2011-2012 academic year. The flight test program is necessary for obtaining unrestricted FAA flight certification for the completed aircraft. A set of test flight cards were created to aid in meeting the 25 to 40 hours of required phase I flight testing. These cards include specific instructions for each test as well as notes intended to help the pilot complete the test program safely. The test program outlined by the completed test cards will allow the CH 701 to safely and successfully advance to unrestricted phase II flight testing.

Nomenclature

CHT = Cylinder Head Temperature
EFIS = Electronic Flight Instrument System
GPS = Global Positioning System
IAS = Indicated Airspeed
MAP = Manifold Air Pressure
MSL = Mean Sea Level
OAT = Outside Air Temperature
POH = Pilot's Operating Handbook
RPM = Revolutions per Minute
STOL = Short Takeoff and Landing
TAS = True Airspeed
V_x = Angle of Climb
V_y = Rate of Climb

I. Introduction

A. Overview of Flight Testing

Flight testing describes the method of experimentally determining an aircraft's performance through actual flight data. Flight tests provide the most accurate level of aircraft performance data available and identify flight characteristics not revealed through theoretical analysis. Because flight testing often involves operating the aircraft through unexplored regions of the flight envelope, it can place the pilot and aircraft in extreme danger. Flight test programs typically emphasize safety as the primary priority of the test program, placing it well above the actual acquisition of test data. Despite efforts to eliminate dangerous situations from arising during a flight test, risky and unforeseen events may still occur. The chances of bringing both the pilot and the aircraft safely back to the ground are drastically increased through exhaustive planning and preparation. Proper planning involves the development of a flight test plan which describes each step of the flight test in high detail and clearly defines the objective of the test flight. Each step in the test plan lists all relevant control inputs and the expected response of the aircraft. Steps are separated into individual phases including the pre-test phase (details pre-flight setup and pre-test flight), one or more testing phases (during which the objective of the test is completed), and the post-test phase (describes return to base and debriefing). Phases of the test which involve greater risk are clearly marked within the plan. To be most

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effective, the plan must be distributed to all personnel involved with the test, particularly to the entire flight crew. Members within the flight crew may receive a shortened copy of the plan with details extraneous to their duties removed to improve the clarity of critical steps and reduce workload. In addition to describing each step within an ideal test, the flight test plan details general emergency procedures for a number of emergency scenarios. These step-by-step instructions are intended to aid the pilot and ground team in resolving the issue and safely landing the aircraft. They are written in a concise, easy-to-read manner that can be followed by personnel who may be under considerable stress, such as the pilot. Common emergencies for which instructions are provided include engine failures, fires, and loss of control power[1].

Preparing for a flight test involves familiarizing all personnel with the flight test plan and taking steps to mitigate possible emergency scenarios. The test should be repeatedly rehearsed on paper and simulated on the ground in the cockpit before the actual flight is performed. Personnel need to be familiar with not only each step in the flight plan, but also with all emergency response procedures. The pilot in particular should have such a strong grasp of emergency procedures that his or her response to one is nearly automatic. Emergency response is further enhanced through the identification of potential emergency landing sites and by notifying air traffic control and emergency services of the manner and location of the test flight being performed.

B. Flight Test Cards

Flight test cards, an example of which can be seen in Fig. 1, are a method of compiling flight test procedures into a simple document. These easy-to-read cards are particularly useful to the flight crew. Typically, a flight test card contains a brief overview of the test, a statement of the test objective, clear step-by-step instructions on how to perform the test flight, and a section on emergency procedures. Additional notifications may be provided warning of specific dangers within the test. Adding a blank area on the test card allows personnel to take notes during the test.

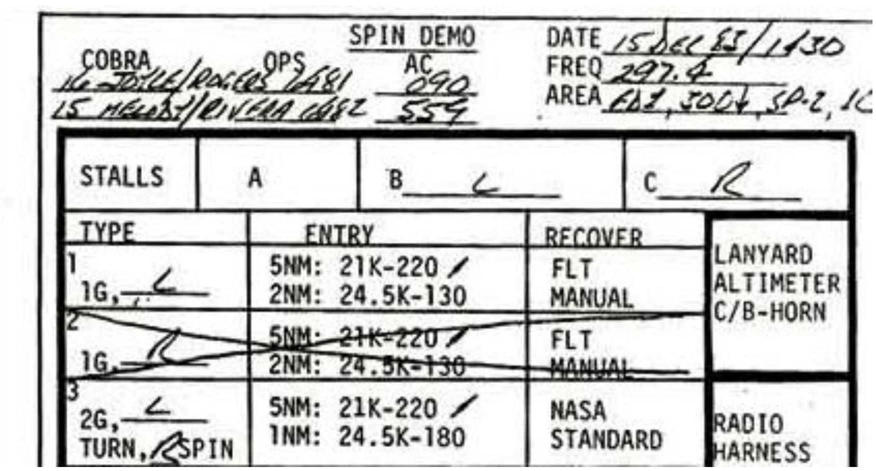

Figure 1. This portion of a test card for a spin performance flight test illustrates a common basic layout for a flight test card[2].

C. Test Flight Certification of the CH 701

Prior to receiving flight certification a homebuilt aircraft is evaluated by an FAA inspector or designated representative. If the aircraft passes inspection it receives an FAA Form 8130-7 Special Airworthiness Certificate for experimental aircraft. However, for the first 25 to 40 flight hours the aircraft operates under "Phase I" test flight rules and is subject to a list of operational limitations. These restrictions specify that the aircraft must be flown with only flight crew onboard and only operated under VFR conditions within a specified airspace. Generally, the provided airspace encircles the aircraft's home airfield and is comprised of a 25-50 mile radius circle centered either over the airfield or a nearby lightly populated area[1]. During these phase I flights a pilot performs a series of tests to verify the airworthiness of the homebuilt aircraft. These tests are conducted to identify critical issues with construction, stability, and performance and to familiarize the pilot with the flying characteristics of the aircraft. Although the pilot may take this opportunity to record flight information, phase one flight tests are not intended to provide detailed performance data. Upon completing the phase one flight test hours the aircraft moves into "Phase II" wherein the experimental aircraft may be flown without the previous operational limitations, although special limitations may still exist due to the specific nature of the aircraft[1].

Phase I flight testing incorporates an experimental aircraft's very first few hours of flight and therefore involves an elevated level of risk as the aircraft is exposed to aerodynamic loads for the very first time. A number of minor to moderate issues, such as lift imbalances or engine irregularities, are expected to reveal themselves during this phase and are addressed upon the completion of each test. However, flight testing is not the experimental phase in which to discover critical issues such as structural failure, engine failure, or any other malfunctions which threaten the survival of the aircraft or pilot. The risk encountered during phase I flight tests is mitigated by performing a number of ground tests and inspections which identify any glaring problems - which are then resolved prior to the flight test phase. Risk is further reduced by the selection of an experienced, capable pilot to perform the first few initial flights, preferably a person experienced with the specific aircraft to be flown, or with aircraft of similar weight and configuration.

The aircraft for which this flight test plan was compiled is a Zenith STOL CH 701. The Zenith is a light aluminum kit aircraft designed for exceptional short-field performance and ease of manufacture. The kit was assembled between Fall 2011 and Summer 2012 by a team consisting mostly of Cal Poly aerospace engineering students, some of who are pictured in Fig. 2. As of June 2012 the aircraft is nearly completed and awaiting FAA certification. One of the final steps towards receiving flight certification is the completion of a series of airworthiness flight tests for which the authors of this report developed a flight test plan. To aid in the completion of phase 1 flight testing, the authors of this report compiled a set of test cards specific to the unique characteristics of the Zenith 701. As a whole, the test flight program validates the aircraft's reliability and aerodynamic performance. The individual steps within each test were tailored according to the expected performance of the aircraft, particularly its capability for extreme slow flight. Additionally, the flight test plan acknowledges the performance limits of the aircraft through the exclusion of maneuvers and flight conditions that would create undue risk to the pilot or aircraft. The primary objective of the flight test program is to complete the first phase of flight testing safely and successfully. The secondary objective of the flight test program is to gather performance information useful to the future operation of the aircraft.

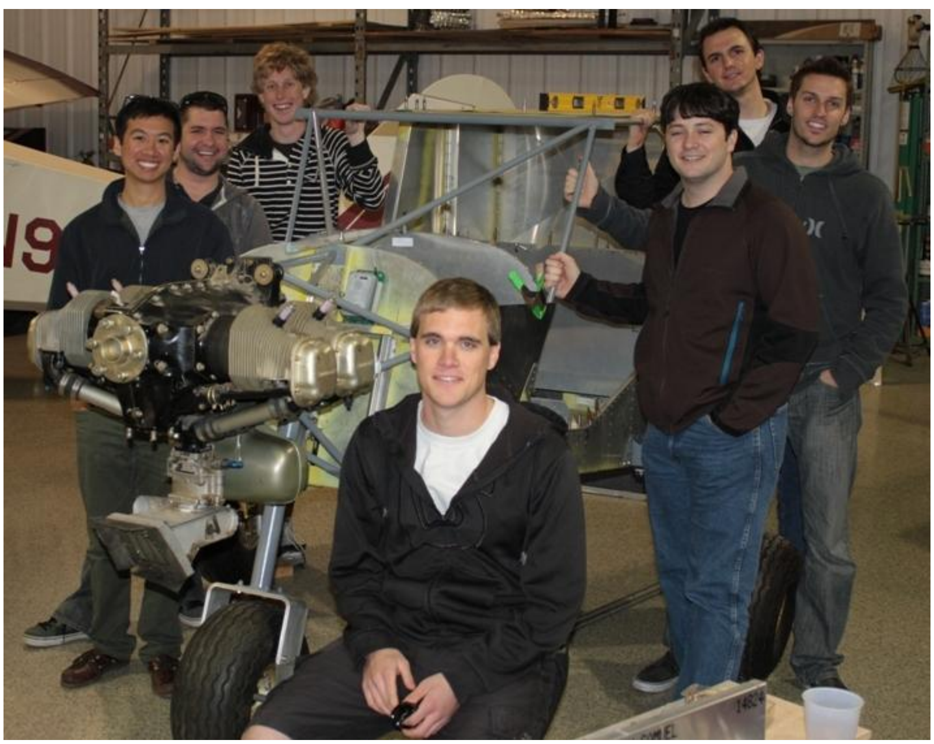

Figure 2. Several members of the CH 701 construction project standing around the partially completed aircraft. Pictured left to right: Dave Nguyen, Michael Roche, Martin Bialy, Kevin Conrad, Spencer Spagnola, Reed Danis, Jordan Coenan.

II. Apparatus

A. Zenith STOL CH 701

The Zenith STOL CH 701 is a light, homebuilt aircraft sold as a kit by the aircraft producer Zenair. The “ultralight” Ch 701 design was first introduced in 1986 and remains in production today[3]. The aircraft was primarily designed for excellent short takeoff and landing performance on rough terrain. The inventor, Chris Heintz, also designed the aircraft to be easy to manufacture. The airframe, seen in Figure 3, is largely composed of simple flat aluminum panels and channel beams which reduce the tooling needed to construct the aircraft. Additionally, the majority of components are assembled using blind rivets, which are easier and quicker to install than solid rivets. Similarly, the pilot’s controls are connected to the control surfaces through simple mechanical linkages. The flight test plan for the 701 incorporates steps to verify that stick forces provide adequate feedback to the pilot without becoming overbearing. Since no means of adjustable trim are provided in the cockpit, the pilot must adjust the trim after completing a test flight.

The slow airspeed and STOL capabilities of the CH 701 are largely provided by the wing, which is equipped with fixed slats, flaps, and flaperons. However, the specific aircraft for which this flight test plan was developed is equipped with aftermarket PegaStol wings, which feature automatic, retractable slats and are discussed in the next section. The empennage of the CH 701 is optimized for low speed flight. The all-moving vertical stabilizer and inverted airfoil horizontal stabilizer provide greater control at low airspeeds then conventional tail configurations. The simple tricycle landing gear of the 701 consists of leaf spring main gear and a nose gear strut utilizing a large bungee cord for shock absorption. The large, low pressure tundra tires give the CH 701 a light footprint and allow it to operate on sandy or muddy ground. The only hydraulic system on the aircraft connects the wheel brakes to the rudder pedals.

Figure 3. The nearly complete CH 701 airframe.

B. PegaStol Wings

PegaStol wings are an aftermarket wing kit for the Zenith CH 701 manufactured by Daedalus Aviation. Compared to the stock 701 wings, PegaStol wings are heavier, provide more lift, allow the aircraft to fly more slowly, and provide more efficient cruise. The aerodynamic performance improvements are due to the use of retracting, rather than fixed, leading edge slats, as seen in Fig. 4. Slat deployment is automatically controlled by aerodynamic forces on the wing. During slow, high angle flight, air pressure forces the slats to extend, increasing the maximum possible lift and preventing stall. As the aircraft transitions to cruise the pressure causes the slats to retract and the wing produces less drag in flight compared to the stock 701 wing. The skin on the PegaStol wing is 0.020’ compared to the 0.016” skin on the stock wing. The thicker skin prevents “oil canning” deformation and increases the structural airspeed limit to 125 MPH, which exceeds the overall aircraft’s NE speed by 15 MPH. The ultimate structural limits

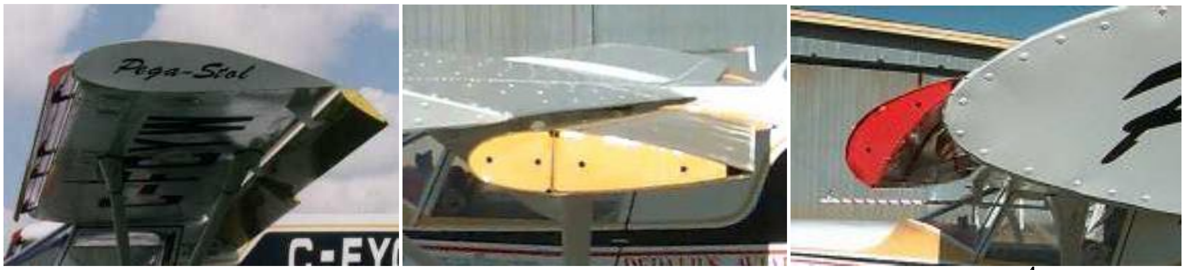

Figure 4. The PegaStol's NACA 2415 airfoil, flaperons, and automatic slats[4].

of the wing are +6G/-4.5G, equal to the limits of the 701 airframe. Because the PegaStol is stronger than the stock wing, it does not constrain the limits of the flight test beyond the limits imposed by the basic airframe. However, because of the PegaStol wing's thicker skin, it is heavier than the stock wing and reduces the aircraft's maximum useful load. An attempt was made to account for this reduction in payload weight by reducing the maximum takeoff gross weight specified by the flight test plan. A more accurate maximum weight will be determined and the test plan modified when the aircraft is completed and weighed.

The airfoil used for the PegaStol wing kit is the NACA 2415. As seen in Fig. 5, the NACA 2415 airfoil has a maximum lift coefficient of 1.4 at an angle of attack of 14 degrees. Extending the wing's flaperons increases the wing's maximum C_L to 2.8. When the automatic slats deploy, wing stall is delayed to an angle of attack of 24°. With both high lift devices deployed, the wing is capable of producing a maximum C_L of 3.6. This translates to a very low landing speed of less than 20 mph being possible[4]. The slats will require a check during the flight test to verify they move freely and deploy and retract at the appropriate flight conditions. The flaps can either be deployed or retracted, with no intermediate settings; many test flights need to be performed in both conditions. The aircraft's flight test speed limits, especially for the slow flight test, are defined according to the slow speed capabilities that the PegaStol wings provide.

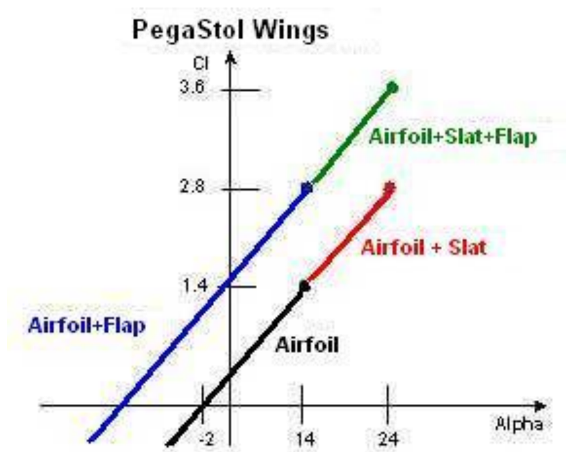

Figure 5. High lift devices allow the PegaStol wing to generate an extremely high C_L[4].

C. Continental O-200-A engine

The Continental O-200-A engine, shown in Fig. 6, is a four-cylinder engine capable of producing 100 horsepower. The O-200-A has a maximum continuous operating limit of 2750 RPM. The continuous RPM limit defines the upper operating RPM limit acceptable during flight test. The engine's oil pressure during idle is a minimum of 10 psi. The normal operating pressure is 30-60 psi. The engine oil's minimum temperature for takeoff is 75°F and the maximum allowable oil temperature is 255°F[5]. This gives the range that the pilot should expect to read when recording engine oil temperature and pressure during the flight tests.

The Continental is not the stock engine used in the CH 701 design and is heavier than the Zenair recommended Rotax engine. Additionally, the 701 for which the flight test plan was developed is not equipped with an electric starter. Because of these changes in weight from the stock model the center of gravity of the aircraft likely deviates from the ideal position and will need to be corrected by adding ballast to the tail. Once the aircraft is completed and balanced, the actual empty weight will need to be compared to the maximum allowable takeoff gross weight to verify no part of the test plan violates the aircraft's weight limits.

Figure 6. The Continental O-200A.

D. EFIS Flight Instrumentation

The CH-701 is equipped with an electronic flight instrument system (EFIS) called the MGL Extreme EFIS, shown in Fig. 7. The EFIS displays all flight information such as calibrated airspeed, altitude, heading, and attitude on a small LCD screen. The EFIS has a built in black box recorder that allows the pilot to record and download all flight data onto a secure digital (SD) card. The EFIS is also capable of creating a 1000 entry automatic flight log to help record information (such as start date & time, flight time, and max altitude and airspeeds reached during flight) to assist in the flight tests[6]. The buttons on the bottom allow the pilot to navigate through the configurable graphic information displays, which are necessary to obtain specific flight information. This will require that the pilot be familiar with use of the EFIS before performing the flight tests. The EFIS may also provide special emergency alerts that the pilots should be able to understand.

Figure 7. The EFIS provides all flight instrumentation on a compact LCD screen[6].

III. Procedure

The flight test plan is comprised of many individual flights that test unique flight characteristics such as stall, stability, and reliability. The order and type of tests included were derived from official FAA recommendation guidelines and a previous flight test plan developed for an RV-7 kit aircraft[1,7].

A. Basic Engine Reliability and Flight Control

This test verifies basic flight airworthiness for the first flight of the aircraft. The objective of this test is to identify any glaring issues with the aircraft and safely return to base. The pilot is instructed to contact the tower and inform the air traffic controllers of the nature of the flight prior to takeoff. The inherent risk of the first flight is mitigated by restricting the test airspace to an area immediately surrounding the airport and avoiding any sudden, violent maneuvers. Flying quality is determined through a series of gentle control inputs that verify the aircraft remains controllable. The pilot closely monitors the flight instruments throughout to flight to verify the engine and avionics are running reliably.

B. Reaffirm first flight findings

One or several additional basic flight airworthiness flights are made to verify the data gathered during the first flight. The pilot determines when enough basic flights have been made to safely transition to further testing.

C. Validate Engine Reliability

One of the most important flight tests is to validate that the engine performance, so this test should be done following the first couple of flight tests. The main things that will need to be checked are the engine oil pressure, temperature, fuel pressure and cylinder head temperatures. While cruising at a certain RPM, the flight test is performed by applying carburetor heat, leaning the fuel mixture, switching fuel tanks, and opening and closing the oil cooler door. Any changes in engine performance will be noted and the engine oil pressures and temperatures can be recorded from the EFIS display. Analysis of the exported EFIS data provides highly accurate, time-based records of how the engine responds to different flight conditions.

D. Slow Flight

The objective of the slow flight test is to gain familiarity with the handling characteristics of the aircraft at low airspeeds. The secondary objective is to test how deploying the flaps affects the aircraft's flying qualities. After reaching cruise altitude, the pilot reduces speed and performs several basic maneuvers. After verifying the aircraft is controllable in slow flight, the pilot deploys the flaps and repeats the maneuvers. The pilot is instructed to avoid entering the stall domain and immediately cease maneuvers, increase throttle, and return to level flight if stall indicators are encountered.

E. Engine Performance during Climb and Descent

The objective of the engine performance during climb and descent test is to monitor the performance of the engine when operating under high and low power settings. This test verifies that the engine operates properly across a range of power settings and temperatures. This test places greater stress on engine components so the flight test card includes a notice warning the pilot to avoid rapid cooling and heating of the engine. Engine performance is monitored by recording the oil pressure, oil temperature, manifold air pressure, cylinder head temperature, and the outside air temperature during a series of climbs and descents. If engine temperatures or pressures reach dangerously high levels, the pilot is to return to a slow cruise until conditions stabilize. Post-test analysis of engine performance reveals any dangerous operating conditions that need to be resolved before further flight.

F. Airspeed In-Flight Accuracy Check

To determine the accuracy of the airspeed indicator, ground tracks will need to be flown with a GPS and across four different engine RPM settings: 1700, 2000, 2400 and 2600 RPM. The ground track consists of flying at 360, 180 and 90 degree heading. Flying at different headings will account for any wind that may affect the speed of the aircraft during this flight test. Indicated airspeed (IAS) and ground speed from the GPS will be recorded while each track is being flown. The RPM will change to verify that the airspeed indicator is accurate across a range of speeds. The recorded data can then be put into an excel sheet provided with the flight test cards to determine the relation between indicated airspeed (IAS) and true airspeed (TAS).

G. Basic Stalls

The objective of the basic stall flight test is to identify the speed at which the aircraft stalls across a range of power and flap deflection settings. A secondary objective of the test is to determine how the aircraft behaves as it enters the stall regime. Power off stalls are initiated from cruise by reducing engine power while attempting to maintain altitude; once the pilot notices stall buffet or any other sign of impending stall, he notes the airspeed, increases engine throttle, and returns to steady, level flight. Power on stalls are accomplished by maintaining high engine RPM and gently increasing elevator deflection to increase the aircraft's angle of attack and reduce speed. Once the aircraft begins to enter stall the pilot notes the speed and returns to steady, level flight. The slat and flaperon system utilized by the PegaStol wings provide the CH 701 with a remarkably low stall speed. The stall flight test also verifies that these high-lift systems are functioning correctly; the pilot visually checks that all four slats deploy successfully prior to stall, and that all four retract once the aircraft resumes cruise flight. A visual inspection of the flaps verifies that the flaps deflect as far as expected.

H. Climb Speeds

This test is done to establish the most optimal rate of climb speed (V_y), angle of climb speed (V_x), and best glide rates. The pilot will also learn to visualize power-off glide and descent rates. This test begins by cruising at 1,500 ft. A climb will then be done at a climb speed of 90 MPH for a minute and the ending altitude and climb rate (in FPM) will be measured. Next, a 85, 180 and 360 degree turn at a 15 degree bank will be performed and the altitude lost will be recorded. This will be repeated at climb speeds of 75, 65, 55 and 45 MPH. The climb speeds can be graphed with the rate of climb to produce a graph similar to the one shown in Fig. 8. The optimal rate of climb speed will be the speed at the peak of the curve of the points produced and the optimal angle of climb speed.

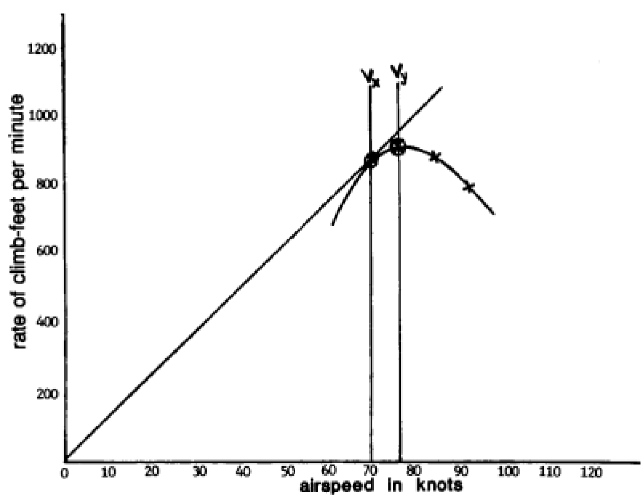

Figure 8. An example rate-of-climb chart demonstrating how to locate the best climb airspeed[1].

I. Stability & Control

This test explores the range of stability displayed by the aircraft. The objective of the test is to safely determine whether the aircraft is both statically and dynamically stable. The pilot first checks longitudinal static stability by deflecting the elevator and verifying aerodynamic forces tend to force the stick in the opposite direction, indicating the aircraft is stable and trying to return to equilibrium. The pilot verifies dynamic longitudinal stability by

introducing an elevator doublet during cruise and recording whether the short-period and phugoid response of the aircraft increases or decreases with time. Lateral/Directional stability is investigated by entering a sideslip and noting roll response when no control input is given to the ailerons. Static directional stability is verified by yawing the aircraft then releasing the rudder and noting the aircraft's response. Finally, the pilot also tests the aircraft's spiral stability by entering a bank and noting the response of the wing level when the controls are released.

J. Advanced Stalls

After verifying basic airworthiness, the flight test program introduces advanced aerodynamic performance testing. The objective of the advanced stalls test is to safely determine aircraft flying qualities during non-basic stalls. The advanced stalls test represents an elevated level of risk, so the test card reminds the pilot to abort the test at the first sign of danger. Airspeed is limited to a slow cruise setting to avoid damaging the airframe. Accelerated stalls are performed by banking then slowly reducing the throttle until the airplane begins to stall. Once the airplane begins to stall the pilot returns to forward flight and increases RPM. The test is repeated in steps of 15° up to a bank angle of 60°.

K. "G" Limit Testing

This flight test is done to ensure that the aircraft meets the "G," or gravitational force, limit capabilities. As stated in the apparatus, the CH 701 has a structural G limit of +6/-4.5 G's. To check if the aircraft meets its G limit capabilities, the flight test will require the pilot to establish a 30 degree bank and to pull back on the stick. The EFIS onboard the CH 701 will be able to output the G limits being achieved. This test will be done to reach 2, 3, 4, 5 and 6 G's. Pulling more than 3 G's can be painful so it is recommended that the pilot only performs the test at a level he is comfortable with. It is up to the pilot's judgment to deem how many G's is appropriate for the CH 701.

L. Exploring Weight & Balance Limits

The objective of this flight test is to determine the effects of changing the aft balance on multiple flight maneuvers. This will be by progressively increasing weights until maximum takeoff weight is established. The pilot will fly with max fuel and use ballast weights secured to the passenger seat of the aircraft. The ballast weights will go from 50 to 130 lbs. Heavier weight tests have not yet been implemented into the flight test as the exact aircraft empty weight has yet to be determined. While in the air, the weight and balance test includes multiple subcategory flights: cruise, slow flight & stalls, stability & control, accelerated stalls, and descent rate. These tests are done to check what happens to the balance of the aircraft during certain flight maneuvers at certain weights.

M. Fuel Consumption

Fuel consumption is a good indication of how much the engine is working for each RPM produced. This test's purpose is to determine the fuel burn rate at different flight conditions. The test will be run for takeoff, climb and descent. The altitude and engine power will be varied as they both affect the amount of fuel the engine consumes. This test will be done with full fuel tanks so that the fuel burn can be more easily measured. The consumption rates for takeoff, climbs and descents can then be calculated with the measured fuel burn.

IV. Results

The general outline of the completed flight test cards is based off a template utilized by Dr. Kurt Colvin to test a homebuilt Van's Aircraft RV-7[8]. The cards incorporate many FAA recommended features such as a space for pilot notes and alerts detailing possible dangers. The cards are intended to provide the pilot of the CH 701 with a set of easy-to-read chronological instructions for completing the flight tests. As can be seen in Fig. 9, each card follows the same general template, including the following sections:

A. Title and Header

The title section of each flight test begins with the flight test's name and its sequence in the flight test program. A space is provided for the pilot to record his name and the current date and time. Immediately following is a list of the test objectives. Each objective provides a short summary of a major goal of the flight test.

B. Flight Test Steps

The largest section of each flight test card is comprised of a series of chronological steps instructing the pilot on how to complete the test. These steps are assembled into a "Check-Action" table that allows the pilot to track their progress by marking each step as it's completed. The steps are grouped into individual flight phases for clarity. Pre-

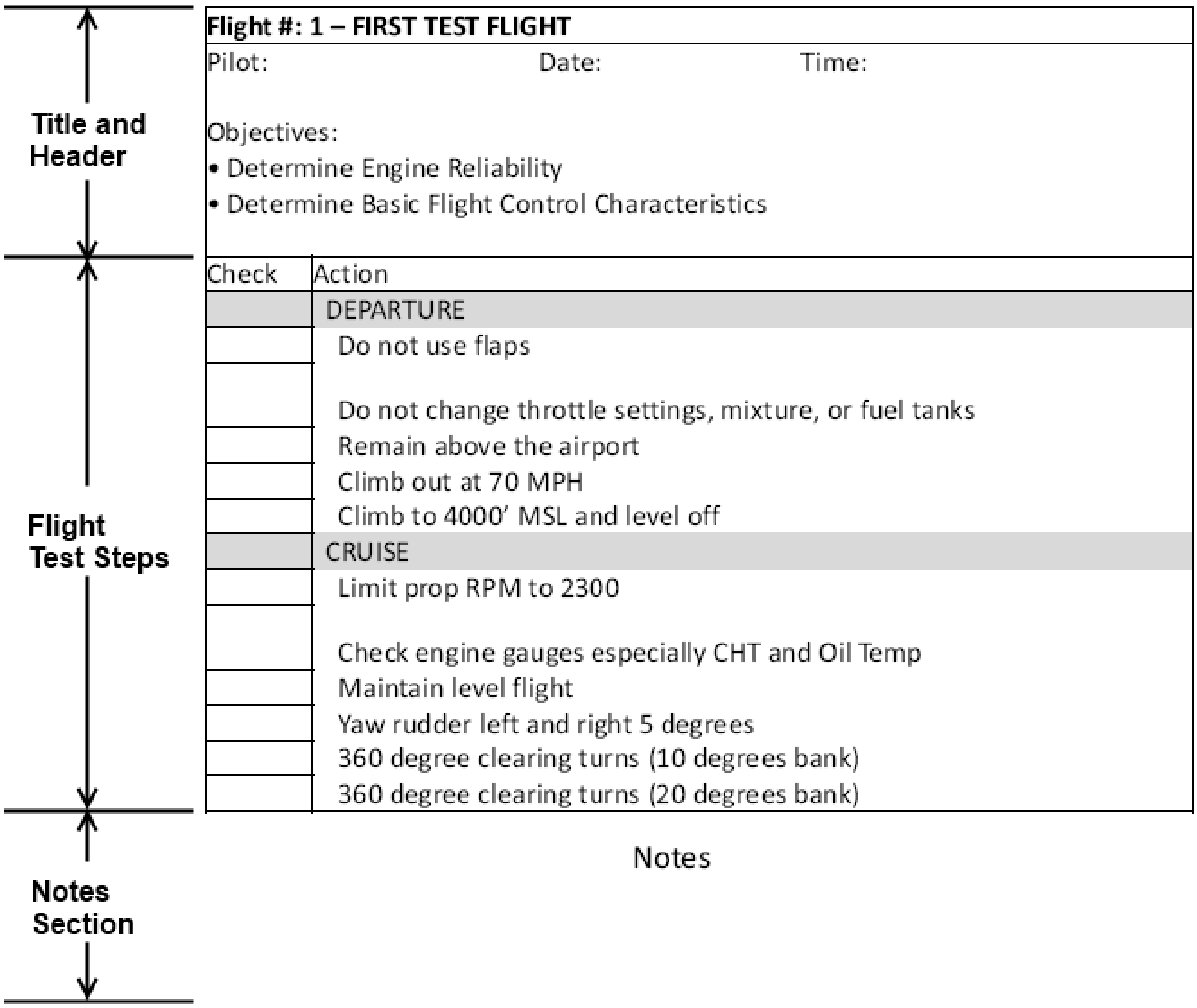

Figure 9. An example of the finalized flight test cards, broken down into major sections.

flight steps describe actions taken before the aircraft is flown. The departure section describes takeoff and climb procedures. Most tests are preceded by a Cruise section which details pre-test procedures. The test itself is broken into however many major flight phases it covers, including climbs, descents, and cruise legs. Each test includes a post-test Landing section which provides details on landing and securing the aircraft. Finally, a Post Flight section instructs test personnel on how to extract and interpret the data gathered during the test, as well as corrective steps that need to be taken before the next flight.

Safety takes priority over following the test plan, so the pilot is to use their own discretion in deciding whether or a particular step is safe to follow. Since phase I flight testing is more about establishing the handling characteristics of the aircraft than obtaining perfect data, a flight test can still be considered successful despite some modifications to its procedure. However, the pilot should record any discrepancies between the written steps and the steps actually taken.

C. Notes Section

Every single test card has a large notes section where the pilot or other flight crew can record anything about the test flight. These notes might be comprised by amendments to certain steps, notes on dangerous conditions, or anything else. Additionally, some tests include pre-written notes to the pilot about specific dangers that might be encountered during the test.

D. Data Tables
Some flight tests include tables for the pilot to hand record data. The cells in each table are purposely large so that the pilot can easily record the data in flight. In addition to handwritten data, the CH 701 is capable of recording flight data on its EFIS system, which can later be downloaded for analysis.

V. Conclusion

A flight test program was developed to assist the pilot of the homebuilt experimental CH 701 in completing phase I FAA flight testing for certification of the aircraft. This flight test program has been planned to fulfill the flight test hours required to complete phase I of certification. Thirteen different flight test procedures were created, each testing a different flight characteristic. Test cards for each flight test were created to aid the pilot in completing each test flight.

Some improvements that could have been made were to have a more in depth analysis of the weight and balances of the aircraft for a more functional exploration of the aircraft's limits. The improved weight and balances flight test would include instructions on adding weight to the cargo compartment of the aircraft to investigate the aircraft's performance characteristics with aft loaded weight. Additionally, a flight test for the slats would provide the pilot with further knowledge of the slat's functionality. A test can be done to determine at what speed the slats deploy and how many extra degrees of angle of attack it allows the aircraft to reach before stalling. One method to perform this test would be to perform a stall test with the slats taped back so that they don't deploy and compare the stall characteristics to a stall test with the slats free to deploy.

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Appendix

The following pages provides the complete set of flight test plan cards

Flight #: 1 – FIRST TEST FLIGHT

Pilot: Date: Time:

Objectives:

- Determine Engine Reliability
- Determine Basic Flight Control Characteristics

Check	Action
	DEPARTURE
	Do not use flaps
	Do not change throttle settings, mixture, or fuel tanks
	Remain above the airport
	Climb out at 70 MPH
	Climb to 4000’ MSL and level off
	CRUISE
	Limit prop RPM to 2300
	Check engine gauges especially CHT and Oil Temp
	Maintain level flight
	Yaw rudder left and right 5 degrees
	360 degree clearing turns (10 degrees bank)
	360 degree clearing turns (20 degrees bank)

Notes

Check	Action
	SLOW FLIGHT
	Climb to 6000' MSL
	Slowly decrease speed to 55 MPH – maintain altitude
	360 degree clearing turns at 20 degrees bank
	Keep ball centered using rudder
	Increase speed to 60 MPH
	Extend flaps
	Slowly decrease speed to 55 MPH – maintain altitude
	360 degree clearing turns at 20 degrees bank
	Keep ball centered using rudder
	Check engine temperatures and pressures
	Increase engine rpm to cruise setting (2300 RPM)
	LANDING
	Perform approach checklist
	Fly pattern at 60 MPH
	Extend flaps
	Taxi back to hangar
	POST FLIGHT
	Download recorded EFIS data
	Prepare corrective action list
	Record fuel and oil consumption
	Pull cowlings and inspect engine carefully
	Inspect airframe carefully

Notes

Flight #: 2 – CONFIRM FIRST FLIGHT RESULTS

Pilot: Date: Time:

Objectives:

- Re-affirm the first flight findings

Check	Action
	DEPARTURE
	Do not use flaps
	Do not change throttle settings, mixture, or fuel tanks
	Remain above the airport
	Climb out at 70 MPH
	Climb to 4000' MSL and level off
	CRUISE
	Limit prop RPM to 2300
	Check engine gauges especially CHT and Oil Temp
	Maintain level flight
	Yaw rudder left and right 5 degrees
	360 degree clearing turns (10 degrees bank)
	360 degree clearing turns (20 degrees bank)

Notes

Check	Action
	SLOW FLIGHT
	Climb to 6000' MSL
	Slowly decrease speed to 55 MPH – maintain altitude
	360 degree clearing turns at 20 degrees bank
	Keep ball centered using rudder
	Increase speed to 60 MPH
	Extend flaps
	Slowly decrease speed to 45 MPH while maintaining altitude
	360 degree clearing turns at 20 degrees bank
	Keep ball centered using rudder
	Add power, climb as if performing a go-around
	Raise flaps
	Check engine temperatures and pressures
	Increase engine rpm to cruise setting (2300 RPM)
	POST FLIGHT
	Download recorded EFIS data
	Prepare corrective action list
	Record fuel and oil consumption
	Pull cowlings and inspect engine carefully
	Inspect airframe carefully

Notes

Flight #: 3 – VALIDATE ENGINE RELIABILITY

Pilot: Date: Time:

Objectives:

- Validate that the engine operates properly

Check	Action
	DEPARTURE
	Do not use flaps
	Do not change throttle settings, mixture, or fuel tanks
	Remain above the airport
	Climb out at 70 MPH
	Climb to 4000’ MSL and level off
	CRUISE
	Limit prop RPM to 2300
	Check engine gauges especially CHT and Oil Temp
	Maintain level flight
	Apply carb heat and note changes
	Lean engine mixture and note changes
	Record engine pressures and temperatures
	POST FLIGHT
	Download recorded EFIS data
	Prepare corrective action list
	Record fuel and oil consumption
	Pull cowlings and inspect engine carefully
	Inspect airframe carefully

Notes

Flight #: 4 – SLOW FLIGHT TEST

Pilot: Date: Time:

Objectives:

- Gain familiarity with slow flight handling characteristics

Check	Action
	DEPARTURE
	Do not use flaps
	Climb out at 70 MPH
	Climb to 6000' MSL and level off
	CRUISE
	Limit prop RPM to 2300
	Check engine gauges especially CHT and Oil Temp
	Maintain level flight
	Perform 2 clearing turns
	Slow to 50 MPH and maintain altitude
	Note handing characteristics
	360 turn left, then 360 right, shallow bank
	Check CHTs & Oil Temp
	Slow to 45 MPH and maintain altitude
	Note handing characteristics
	360 turn left, 360 turn right, shallow bank
	Check CHTs and Oil Temp
	Slow to 40 MPH and maintain altitude
	Note handing characteristics
	360 turn left, 360 turn right, shallow bank
	Perform 360 turn left, 360 turn right

Notes

Check	Action
	POST FLIGHT
	Download recorded EFIS data
	Prepare corrective action list
	Record fuel and oil consumption

Notes

Flight #: 5 – CLIMBS AND DESCENTS

Pilot: Date: Time:

Objectives:

- Monitor engine performance and reliability during climbs and descents

Check	Action
	DEPARTURE
	Do not use flaps
	Climb out at 70 MPH
	Climb to 2000’ MSL and level off
	CRUISE
	Limit prop RPM to 2300
	Check engine gauges especially CHT and Oil Temp
	Maintain level flight
	85 MPH climb for two minutes – full power
	Record OAT, engine temperatures, and pressures
	Stabilize engine temperatures
	80 MPH climb for two minutes – full power
	Record OAT, engine temperatures, and pressures
	Stabilize engine temperatures
	Moderate power descent to 2000 ‘ – do not exceed 100 MPH
	75 MPH climb for two minutes – full power
	Record OAT, engine temperatures, and pressures
	Stabilize engine temperatures
	70 MPH climb for two minutes – full power
	Record OAT, engine temperatures, and pressures
	Stabilize engine temperatures

Notes

Avoid overheating and shock cooling engine. Allow engine to slowly stabilize temperature during test.

Consider performing elements of this test in conjunction with other flight tests to avoid over-stressing the engine.

	POST FLIGHT
	Download recorded EFIS data
	Prepare corrective action list
	Record fuel and oil consumption

Notes

Flight #: 6 – AIRSPEED IN-FLIGHT ACCURACY CHECK	
Pilot: Date: Time:	
Objectives: • Determine accuracy of the airspeed indicator	
Check	Action
	PRE-FLIGHT
	Determine altitudes at which you desire airspeed data.
	DEPARTURE
	Do not use flaps
	Climb out at 70 MPH
	Climb to 2000’ MSL and level off
	CRUISE
	Limit prop RPM to 1700
	Check engine gauges especially CHT and Oil Temp
	Maintain level flight
	Adjust Mixture
	1700 RPM, constant altitude - 5000' MSL

Notes

This test should be performed at the same IAS and altitude for each ground track run.

Allow the airspeed and altitude indicators to settle between runs.

Check	Action
	Record OAT
	Record MAP
	Fly ground track at a bearing of 360
	Record IAS from airspeed indicator
	Record ground speed from GPS
	Fly ground track at a bearing of 180
	Record IAS from airspeed indicator
	Record ground speed from GPS
	Fly ground track at a bearing of 90
	Record IAS from airspeed indicator
	Record ground speed from GPS
	Record ground track from GPS
	Altitude: 5000' MSL
	Throttle: 1700 RPM

Notes

	360	180	90
OAT			
MAP			
IAS			
Ground Speed			

Check	Action
	Set power 2000 RPM, constant altitude - 5000' MSL
	Reset Mixture
	Record MAP
	Fly ground track at a bearing of 360
	Record IAS from airspeed indicator
	Record ground speed from GPS
	Fly ground track at a bearing of 180
	Record IAS from airspeed indicator
	Record ground speed from GPS
	Fly ground track at a bearing of 90
	Record IAS from airspeed indicator
	Record ground speed from GPS

Notes

	360	180	90
MAP			
IAS			
Ground Speed			

Check	Action
	Set power 2400 RPM, constant altitude - 5000' MSL
	Reset Mixture
	Record MAP
	Fly ground track at a bearing of 360
	Record IAS from airspeed indicator
	Record ground speed from GPS
	Fly ground track at a bearing of 180
	Record IAS from airspeed indicator
	Record ground speed from GPS
	Fly ground track at a bearing of 90
	Record IAS from airspeed indicator
	Record ground speed from GPS

Notes

	360	180	90
MAP			
IAS			
Ground Speed			

Check	Action
	Set power 2600 RPM, constant altitude - 5000' MSL
	Reset Mixture
	Record MAP
	Fly ground track at a bearing of 360
	Record IAS from airspeed indicator
	Record ground speed from GPS
	Fly ground track at a bearing of 180
	Record IAS from airspeed indicator
	Record ground speed from GPS
	Fly ground track at a bearing of 90
	Record IAS from airspeed indicator
	Record ground speed from GPS

Notes

	360	180	90
MAP			
IAS			
Ground Speed			

Check	Action
	POST FLIGHT
	Download recorded EFIS data
	Prepare corrective action list
	Record fuel and oil consumption
	Calculate True Airspeeds using the Excel Spreadsheet
	Update Flight Operations Manual

Notes

By using the attached Excel Spreadsheet, your ground track does not have to be exactly on the cardinal heading. If it isn't, record the ground track you did have on the spreadsheet.

What you're testing is the accuracy of your airspeed indicator. Consider doing this test at close to stall speeds w/ & w/out flaps to get an idea of your TAS for stall speed.

Flight #: 7 – STALLS

Pilot: Date: Time:

Objectives:

- Determine actual stall speeds in landing and takeoff configuration

Check	Action
	PRE-FLIGHT
	Fill fuel tanks to full
	DEPARTURE
	Do not use flaps
	Climb out at 70 MPH
	Climb to 6000’ MSL and level off
	CRUISE
	Limit prop RPM to 2200
	Check engine gauges especially CHT and Oil Temp
	Maintain level flight

Notes

Check	Action
	POWER OFF STALLS
	No flaps
	Slowly decelerate while maintaining altitude
	Keep ball centered with rudder
	Verify slats deploy
	Note stall speed
	Recover altitude and speed
	Slow down to 40 MPH
	Extend flaps
	Slowly decelerate while maintaining altitude
	Keep ball centered with rudder
	Verify slats deploy
	Note stall speed
	Retract flaps
	Recover altitude and speed

Notes

Consider repeating flight test with slats taped to determine stall speed without slats.

	Speed IAS (MPH)
POWER-OFF STALL, NO FLAP:	
POWER-OFF STALL, FULL FLAP:	

Check	Action
	POWER ON STALLS
	Set power to 2200 RPM
	Slowly pull back elevator
	Keep ball centered with rudder
	Verify slats deploy
	Note stall speed
	Recover altitude and speed
	Full power
	Slowly pull back elevator
	Keep ball centered with rudder
	Verify slats deploy
	Note stall speed
	Recover altitude and speed
	POST FLIGHT
	Download recorded EFIS data
	Prepare corrective action list
	Record fuel and oil consumption
	Update POH with actual stall speeds

Notes

	Speed IAS (MPH)
POWER-ON STALL, 2200 RPM, NO FLAP:	
POWER-ON STALL, FULL POWER:	

Flight #: 8 – CLIMB SPEEDS

Pilot: Date: Time:

Objectives:

- Establish best rate of climb speed (Vy)
- Establish best angle of climb speed (Vx)
- Establish best glide rates
- Learn to visualize power-off glide descent

Check	Action
	PRE-FLIGHT
	Bring small stopwatch/timer
	DEPARTURE
	Do not use flaps
	Climb out at 70 MPH
	Climb to 1500’ MSL and level off
	CRUISE
	Limit prop RPM to 2200
	Check engine gauges especially CHT and Oil Temp
	Maintain level flight, Full rich mixture
	Do 2 clearing turns

Notes

Don't cook the engine and don't shock cool the engine. These tests might be best done over several flights in conjunction with other tests.

Check	Action
	CLIMB TEST#1
	Climb at 85 MPH
	Begin 1 minute timer at 2000' MSL
	At end of 1 minute, record altitude
	Cool Engine
	GLIDE TEST #1
	Descend at 85 MPH
	Record descent rate from VSI
	Perform a 90 degree turn at 15 deg. bank and record altitude lost
	Perform 180 degree turn at 15 deg. bank and record altitude lost
	Perform 360 degree turn at 15 deg. bank and record altitude lost

Notes

IAS (MPH)	Climbed to:	Climb Rate (FPM)	Descent Rate (FPM)	90 Turn	180 Turn	360 Turn
85						

Check	Action
	CLIMB/DESCENT TEST#2
	Climb at 75 MPH
	Begin 1 minute timer at 2000' MSL
	At end of 1 minute, record altitude
	Cool Engine
	Descend at 75 MPH, Record Rate
	Perform & record altitude lost in 90, 180 & 360 turns
	CLIMB/DESCENT TEST#3
	Climb at 65 MPH
	Begin 1 minute timer at 2000' MSL
	At end of 1 minute, record altitude
	Descend to 1500 MSL
	Cool Engine
	Descend at 65 MPH, Record Rate
	Perform & record altitude lost in 90, 180 & 360 turns

Notes

IAS (MPH)	Climbed to:	Climb Rate (FPM)	Descent Rate (FPM)	90 Turn	180 Turn	360 Turn
75						
65						

WARNING: At slower airspeeds (below 65 mph), this aircraft may be at a very nose high configuration, and may exhibit dangerous flight characteristics. If unsafe conditions are encountered, abort the test and increase airspeed; Do not perform the test for these slow airspeeds.

Check	Action
	CLIMB/DESCENT TEST#4
	Climb at 55 MPH
	Begin 1 minute timer at 2000' MSL
	At end of 1 minute, record altitude
	Cool Engine
	Descend at 55 MPH, Record Rate
	Perform & record altitude lost in 90, 180 & 360 turns
	CLIMB/DESCENT TEST#5
	Climb at 45 MPH
	Begin 1 minute timer at 2000' MSL
	At end of 1 minute, record altitude
	Descend to 1500 MSL
	Cool Engine
	Descend at 45 MPH, Record Rate
	Perform & record altitude lost in 90, 180 & 360 turns

Notes

IAS (MPH)	Climbed to:	Climb Rate (FPM)	Descent Rate (FPM)	90 Turn	180 Turn	360 Turn
55						
45						

Check	Action
	LANDING
	Perform approach checklist
	Fly pattern at 60 MPH
	Taxi back to hangar
	POST FLIGHT
	Download recorded EFIS data
	Prepare corrective action list
	Record fuel and oil consumption
	Use graph to compute Vy and Vx
	Use graph to compute best glide speed

Notes

Flight #: 9 – STABILITY AND CONTROL CHECKS

Pilot: Date: Time:

Objectives:
- Determine longitudinal stability
- Determine lateral-directional stability
- Determine spiral stability

Check	Action
	PRE-FLIGHT
	These tests cannot be accomplished until trim tabs and control surfaces have been adjusted to allow hands off flight
	DEPARTURE
	Do not use flaps
	Climb out at 70 MPH
	Climb to 6000' MSL and level off
	CRUISE
	Limit prop RPM to 2300
	Check engine gauges especially CHT and Oil Temp
	Maintain level flight

Notes

Check	Action
	LONGITUDINAL STABILITY TEST
	Record airspeed at 2300 RPM
	Lightly pull on stick to reduce airspeed by 10%
	Does the aircraft require a continued pull force to maintain the new airspeed?
	If no: abort test
	If yes: Pull stick to reduce airspeed by 20%
	Does aircraft require still more pull force to maintain airspeed?
	If yes: CH 701 has POSITIVE static stability
	If no to either B or C airspeed, CH 701 has NEUTRAL static stability
	If CH 701 requires a push force for B or C airspeeds, then CH 701 has NEGATIVE static stability
	REPEAT
	Test by PUSHING stick instead of PULLING

Notes

Check	Action
	TEST FOR POSITIVE DYNAMIC LONGITUDINAL STABILITY (SHORT PERIOD)
	Cruise at 2300 RPM
	Push nose down 5 degrees, then up to level attitude
	As attitude reaches level, release stick
	If CH 701 briefly oscillates about level attitude before
	settling to level then CH 701 has POSITIVE
	TEST FOR POSITIVE DYNAMIC LONGITUDINAL STABILITY (LONG PERIOD)
	Cruise at 2300 RPM
	Pull stick up to reduce speed by 5 MPH, Release stick
	Expect CH 701 to oscillate about the cruise speed before vertical motion dampens out
	If amplitude INCREASES with time = NEGATIVE DLS
	If amplitude CONTINUES to oscillate = NEUTRAL DLS
	If CH 701 returns to cruise attitude & speed = POSITIVE DLS

Notes

Check	Action
	TEST FOR LATERAL/DIRECTIONAL CONTROL STABILITY
	Set low cruise speed (50 MPH)
	Slowly enter a sideslip until either full rudder or full aileron deflection
	Release aileron while holding full rudder
	•low wing should rise to level
	TEST FOR STATIC DIRECTIONAL STABILITY
	Set low cruise speed (50 MPH)
	Slowly yaw CH 701 with rudder while keeping aircraft level with aileron ----- release rudder
	CH 701 should return to no yaw condition
	TEST SPIRAL STABILITY
	(This will demonstrate the aircraft's tendency to raise the low wing when controls are released in a bank)
	Bank 15 to 20 degrees and release controls
	•If bank angle DECREASES = POSITIVE SS
	•If bank angle STAYS THE SAME = NEUTRAL SS
	•If bank angle INCREASES = NEGATIVE SS

Notes

Check	Action
	LANDING
	Perform approach checklist
	Fly pattern at 60 MPH
	Taxi back to hangar
	POST FLIGHT
	Download recorded EFIS data
	Prepare corrective action list
	Record fuel and oil consumption
	Adjust trim tabs and control surfaces as needed

Notes

Flight #: 10 – ACCELERATED STALLS

Pilot: Date: Time:

Objectives:

- Further explore stall characteristics of the aircraft

Check	Action
	PRE-FLIGHT
	Consider wearing a parachute & practice egress
	DEPARTURE
	Do not use flaps
	Climb out at 70 MPH
	Climb to 10,000' MSL and level off
	CRUISE
	Limit Airspeed to slow cruise speed (50 MPH)
	Check engine gauges especially CHT and Oil Temp
	Maintain level flight

Notes

Check	Action
	ACCELERATED STALL TEST
	Hold 15 degrees bank and slow the aircraft until stall
	Record airspeed at stall for 15 degrees
	Repeat for 30, 45 and 60 (2g) degrees of bank
	LANDING
	Perform approach checklist
	Fly pattern at 60 MPH
	Taxi back to hangar
	POST FLIGHT
	Download recorded EFIS data
	Prepare corrective action list
	Record fuel and oil consumption

Notes

Bank (Degrees)	Airspeed at stall
15	
30	
45	
60	

Flight #: 11 – "G" LIMIT TESTING

Pilot: Date: Time:

Objectives:

• Verify aircraft meets the "G" limit capabilities

Check	Action
	PRE-FLIGHT
	Verify Weight & Balance is within Aerobatic limits
	Consider wearing parachute and practice egress
	DEPARTURE
	Do not use flaps
	Climb out at 70 MPH
	Climb to 10,000’ MSL and level off
	CRUISE
	Limit prop RPM to 2300
	Check engine gauges especially CHT and Oil Temp
	Maintain level flight
	Make 2 clearing turns

Notes

Check	Action
	Establish 30 degree bank & pull on stick to achieve 2 G
	Release pressure & fly straight & level
	Establish 30 degree bank & pull on stick to achieve 3 G
	Release pressure & fly straight & level
	Establish 30 degree bank & pull on stick to achieve 4 G
	Release pressure & fly straight & level
	Establish 30 degree bank & pull on stick to achieve 5 G
	Release pressure & fly straight & level
	Establish 30 degree bank & pull on stick to achieve 6 G
	Release pressure & fly straight & level
	POST FLIGHT
	Download recorded EFIS data
	Prepare corrective action list
	Record fuel and oil consumption

Notes

Use your own judgment to determine if anything over 3 g's is really appropriate for you and/or the airplane.

Flight #: 12a – EXPLORE WEIGHT & BALANCE LIMITS	
Pilot: Date: Time:	
Objectives: • Determine affect of change to aft balance and progressively increasing weights to establish maximum weight • Pilot (me) plus 50 lb. passenger & max. fuel	
Check	Action
	PRE-FLIGHT
	These tests cannot be accomplished until a Weight and Balance check is performed on the completed aircraft and the TOGW and CG limits have been determined.
	Carefully weigh and secure ballast
	Compute & record new weight & balance
	DEPARTURE
	Note: Consider deploying flaps to help lift tail if needed
	Climb out at 70 MPH
	Climb to 6000’ MSL and level off
	Record climb performance
	CRUISE
	Limit prop RPM to 2300
	Check engine gauges especially CHT and Oil Temp
	Maintain level flight

Notes

Salt bags work well as ballast. Make sure they are securely belted in.

The objective is to incrementally test the affect of increased weight and aft weight on the aircraft handling. DO NOT EXCEED GROSS WEIGHT. STAY WITHING THE FORE/AFT CG LIMITS.

Climb Performance (fpm)

Check	Action
	SLOW FLIGHT & STALLS
	360 turns, slow flight & power off stall w/ no flaps and full flaps,
	recover
	Execute power-on stalls at 2200 RPM
	STABILITY & CONTROL CHECKS
	Longitudinal Stability: Record Airspeed at 2200 RPM
	Pull to reduce airspeed by 10%
	Does pitch up attitude require continued pull?
	Yes=Positive LS
	Perform LS push test
	Lateral/Directional Control Stability: Sideslip
	Release Aileron (keep rudder), Do wings level?
	Static Directional Stability:
	Yaw w/ level wings, release
	rudder. Return to no yaw?
	Spiral Stability:
	Bank 15 deg., release. Return to level?

Notes

Check	Action
	ACCELERATED STALLS
	15 Degree bank, slow until stalls: Repeat w/ 30, 45, 60
	DESCENT RATE
	Descend at 85 MPH, Record Rate. Record loss of elevation w/ 90, 180, 360 degree turns
	POST FLIGHT
	Download recorded EFIS data
	Prepare corrective action list
	Record fuel and oil consumption

Notes

Weight	IAS (MPH)	Descent Rate (FPM)	90 Turn	180 Turn	360 Turn
50 lb	85				

Weight	Fuel Consumption	Oil Consumption
50 lb		

Flight #: 12a – EXPLORE WEIGHT & BALANCE LIMITS

Pilot: Date: Time:

Objectives:

• Determine affect of change to aft balance and progressively increasing weights to establish maximum weight

• Pilot (me) plus 90 lb. passenger & max. fuel

Check	Action
	PRE-FLIGHT
	These tests cannot be accomplished until a Weight and Balance check is performed on the completed aircraft and the TOGW and CG limits have been determined.
	Carefully weigh and secure ballast
	Compute & record new weight & balance
	DEPARTURE
	Note: Consider deploying flaps to help lift tail if needed
	Climb out at 70 MPH
	Climb to 6000' MSL and level off
	Record climb performance
	CRUISE
	Limit prop RPM to 2300
	Check engine gauges especially CHT and Oil Temp
	Maintain level flight

Notes

Climb Performance (fpm)

Check	Action
	SLOW FLIGHT & STALLS
	360 turns, slow flight & power off stall w/ no flaps and full flaps,
	recover
	Execute power-on stalls at 2200 RPM
	STABILITY & CONTROL CHECKS
	Longitudinal Stability: Record Airspeed at 2200 RPM
	Pull to reduce airspeed by 10%
	Does pitch up attitude require continued pull?
	Yes=Positive LS
	Perform LS push test
	Lateral/Directional Control Stability: Sideslip
	Release Aileron (keep rudder), Do wings level?
	Static Directional Stability:
	Yaw w/ level wings, release
	rudder. Return to no yaw?
	Spiral Stability:
	Bank 15 deg., release. Return to level?

Notes

Check	Action
	ACCELERATED STALLS
	15 Degree bank, slow until stalls: Repeat w/ 30, 45, 60
	DESCENT RATE
	Descend at 85 MPH, Record Rate. Record loss of elevation w/ 90, 180, 360 degree turns
	POST FLIGHT
	Download recorded EFIS data
	Prepare corrective action list
	Record fuel and oil consumption

Notes

Weight	IAS (MPH)	Descent Rate (FPM)	90 Turn	180 Turn	360 Turn
90 lb	85				

Weight	Fuel Consumption	Oil Consumption
90 lb		

Flight #: 12a – EXPLORE WEIGHT & BALANCE LIMITS

Pilot: Date: Time:

Objectives:

- Determine affect of change to aft balance and progressively increasing weights to establish maximum weight
  - Pilot (me) plus 130 lb. passenger & max. fuel

Check	Action
	PRE-FLIGHT
	These tests cannot be accomplished until a Weight and Balance check is performed on the completed aircraft and the TOGW and CG limits have been determined.
	Carefully weigh and secure ballast
	Compute & record new weight & balance
	DEPARTURE
	Note: Consider deploying flaps to help lift tail if needed
	Climb out at 70 MPH
	Climb to 6000' MSL and level off
	Record climb performance
	CRUISE
	Limit prop RPM to 2300
	Check engine gauges especially CHT and Oil Temp
	Maintain level flight

Notes

Climb Performance (fpm)

Check	Action
	SLOW FLIGHT & STALLS
	360 turns, slow flight & power off stall w/ no flaps and full flaps,
	recover
	Execute power-on stalls at 2200 RPM
	STABILITY & CONTROL CHECKS
	Longitudinal Stability: Record Airspeed at 2200 RPM
	Pull to reduce airspeed by 10%
	Does pitch up attitude require continued pull?
	Yes=Positive LS
	Perform LS push test
	Lateral/Directional Control Stability: Sideslip
	Release Aileron (keep rudder), Do wings level?
	Static Directional Stability:
	Yaw w/ level wings, release
	rudder. Return to no yaw?
	Spiral Stability:
	Bank 15 deg., release. Return to level?

Notes

Check	Action
	ACCELERATED STALLS
	15 Degree bank, slow until stalls: Repeat w/ 30, 45, 60
	DESCENT RATE
	Descend at 85 MPH, Record Rate. Record loss of elevation w/ 90, 180, 360 degree turns
	POST FLIGHT
	Download recorded EFIS data
	Prepare corrective action list
	Record fuel and oil consumption

Notes

Weight	IAS (MPH)	Descent Rate (FPM)	90 Turn	180 Turn	360 Turn
130 lb	85				

Weight	Fuel Consumption	Oil Consumption
130 lb		

Flight #: 13a – FUEL CONSUMPTION - Takeoff and climb/descent

Pilot: Date: Time:

Objectives:

- Determine fuel burn during takeoff and climb/descent to/from 3500’

Check	Action
	PRE-FLIGHT
	Fill all tanks to full
	DEPARTURE
	Climb out at 70 MPH
	Climb to 3500’ MSL and level off
	LANDING
	Descend to land
	Perform approach checklist
	Fly pattern at 60 MPH
	Taxi back to hangar
	POST FLIGHT
	Refill all tanks to full
	Record fuel added to all tanks
	Fuel burned for climb/descent = fuel added to all tanks
	Download recorded EFIS data
	Prepare corrective action list
	Record oil consumption

Notes

Altitude: 3500’		
Fuel Added	Fuel Burn for Climb/Descent	Oil Consumption

Flight #: 13a – FUEL CONSUMPTION - Cruise	
Pilot: Date: Time: Objectives: • Determine fuel burn at various power settings at 3500’	
Check	Action
	PRE-FLIGHT
	Create GPS racetrack w/ 10 mile legs
	Fill all tanks to full
	DEPARTURE
	Climb out at 70 MPH
	Climb to 3500’ MSL and level off
	CRUISE
	Cruise 2300 RPM, Record IAS
	Start Timer for 30 minutes, Fly racetrack
	Record MAP, OAT, and everything else
	LANDING
	At end of 30 minutes, descend to land
	Perform approach checklist
	Fly pattern at 60 MPH
	Taxi back to hangar

Notes

Altitude: 3500’			
IAS (MPH) for Cruise	MAP	OAT	Oil Temp

CHT for each head			

Check	Action
	POST FLIGHT
	Refill all tanks to full
	Record fuel added to all tanks
	Fuel burned for cruise = (fuel added to all tanks) - (fuel burned for climb/descent from previous test)
	Download recorded EFIS data
	Prepare corrective action list
	Record oil consumption
	Repeat at this altitude using 2500, 2600 and 2700 RPM

Notes

Altitude: 3500’			
RPM	Fuel Added	Fuel Burn for Cruise	Oil Consumption
2300			
2500			
2600			
2700			

Flight #: 13a – FUEL CONSUMPTION - Takeoff and climb/descent

Pilot: Date: Time:

Objectives:

• Determine fuel burn during takeoff and climb/descent to/from 5500’

Check	Action
	PRE-FLIGHT
	Fill all tanks to full
	DEPARTURE
	Climb out at 70 MPH
	Climb to 5500’ MSL and level off
	LANDING
	Descend to land
	Perform approach checklist
	Fly pattern at 60 MPH
	Taxi back to hangar
	POST FLIGHT
	Refill all tanks to full
	Record fuel added to all tanks
	Fuel burned for climb/descent = fuel added to all tanks
	Download recorded EFIS data
	Prepare corrective action list
	Record oil consumption

Notes

Altitude: 5500’		
Fuel Added	Fuel Burn for Climb/Descent	Oil Consumption

Flight #: 13a – FUEL CONSUMPTION - Cruise

Pilot: Date: Time:

Objectives:

- Determine fuel burn at various power settings at 5500’

Check	Action
	PRE-FLIGHT
	Create GPS racetrack w/ 10 mile legs
	Fill all tanks to full
	DEPARTURE
	Climb out at 70 MPH
	Climb to 5500’ MSL and level off
	CRUISE
	Cruise 2300 RPM, Record IAS
	Start Timer for 30 minutes, Fly racetrack
	Record MAP, OAT, and everything else
	LANDING
	At end of 30 minutes, descend to land
	Perform approach checklist
	Fly pattern at 60 MPH
	Taxi back to hangar

Notes

Altitude: 5500’			
IAS (MPH) for Cruise	MAP	OAT	Oil Temp

CHT for each head			

Check	Action
	POST FLIGHT
	Refill all tanks to full
	Record fuel added to all tanks
	Fuel burned for cruise = (fuel added to all tanks) - (fuel burned for climb/descent from previous test)
	Download recorded EFIS data
	Prepare corrective action list
	Record oil consumption
	Repeat at this altitude using 2500, 2600 and 2700 RPM

Notes

Altitude: 5500’			
RPM	Fuel Added	Fuel Burn for Cruise	Oil Consumption
2300			
2500			
2600			
2700			

Flight #: 13a – FUEL CONSUMPTION - Takeoff and climb/descent

Pilot:	Date:	Time:

Objectives:

• Determine fuel burn during takeoff and climb/descent to/from 7500’

Check	Action
	PRE-FLIGHT
	Fill all tanks to full
	DEPARTURE
	Climb out at 70 MPH
	Climb to 7500’ MSL and level off
	LANDING
	Descend to land
	Perform approach checklist
	Fly pattern at 60 MPH
	Taxi back to hangar
	POST FLIGHT
	Refill all tanks to full
	Record fuel added to all tanks
	Fuel burned for climb/descent = fuel added to all tanks
	Download recorded EFIS data
	Prepare corrective action list
	Record oil consumption

Notes

Altitude: 7500’		
Fuel Added	Fuel Burn for Climb/Descent	Oil Consumption

Flight #: 13a – FUEL CONSUMPTION - Cruise

Pilot: Date: Time:

Objectives:

- Determine fuel burn at various power settings at 7500’

Check	Action
	PRE-FLIGHT
	Create GPS racetrack w/ 10 mile legs
	Fill all tanks to full
	DEPARTURE
	Climb out at 70 MPH
	Climb to 7500’ MSL and level off
	CRUISE
	Cruise 2300 RPM, Record IAS
	Start Timer for 30 minutes, Fly racetrack
	Record MAP, OAT, and everything else
	LANDING
	At end of 30 minutes, descend to land
	Perform approach checklist
	Fly pattern at 60 MPH
	Taxi back to hangar

Notes

Altitude: 7500’			
IAS (MPH) for Cruise	MAP	OAT	Oil Temp

CHT for each head			

Check	Action
	POST FLIGHT
	Refill all tanks to full
	Record fuel added to all tanks
	Fuel burned for cruise = (fuel added to all tanks) - (fuel burned for climb/descent from previous test)
	Download recorded EFIS data
	Prepare corrective action list
	Record oil consumption
	Repeat at this altitude using 2500, 2600 and 2700 RPM

Notes

Altitude: 7500’			
RPM	Fuel Added	Fuel Burn for Cruise	Oil Consumption
2300			
2500			
2600			
2700			

Flight #: 13a – FUEL CONSUMPTION - Takeoff and climb/descent

Pilot: Date: Time:

Objectives:

- Determine fuel burn during takeoff and climb/descent to/from 9500’

Check	Action
	PRE-FLIGHT
	Fill all tanks to full
	DEPARTURE
	Climb out at 70 MPH
	Climb to 9500’ MSL and level off
	LANDING
	Descend to land
	Perform approach checklist
	Fly pattern at 60 MPH
	Taxi back to hangar
	POST FLIGHT
	Refill all tanks to full
	Record fuel added to all tanks
	Fuel burned for climb/descent = fuel added to all tanks
	Download recorded EFIS data
	Prepare corrective action list
	Record oil consumption

Notes

Altitude: 9500’		
Fuel Added	Fuel Burn for Climb/Descent	Oil Consumption

Flight #: 13a – FUEL CONSUMPTION - Cruise

Pilot: Date: Time:

Objectives:

• Determine fuel burn at various power settings at 9500’

Check	Action
	PRE-FLIGHT
	Create GPS racetrack w/ 10 mile legs
	Fill all tanks to full
	DEPARTURE
	Climb out at 70 MPH
	Climb to 9500’ MSL and level off
	CRUISE
	Cruise 2300 RPM, Record IAS
	Start Timer for 30 minutes, Fly racetrack
	Record MAP, OAT, and everything else
	LANDING
	At end of 30 minutes, descend to land
	Perform approach checklist
	Fly pattern at 60 MPH
	Taxi back to hangar

Notes

Altitude: 9500’			
IAS (MPH) for Cruise	MAP	OAT	Oil Temp

CHT for each head			

Check	Action
	POST FLIGHT
	Refill all tanks to full
	Record fuel added to all tanks
	Fuel burned for cruise = (fuel added to all tanks) - (fuel burned for climb/descent from previous test)
	Download recorded EFIS data
	Prepare corrective action list
	Record oil consumption
	Repeat at this altitude using 2500, 2600 and 2700 RPM

Notes

Altitude: 9500’			
RPM	Fuel Added	Fuel Burn for Cruise	Oil Consumption
2300			
2500			
2600			
2700			