Comparison of the Effectiveness of a Personal Computer Aviation Training Device, a Flight Training Device, and an Airplane in Conducting Instrument Proficiency Checks

Semi - Annual Report

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From September 20, 2001 to March 19, 2002

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EXECUTIVE SUMMARY

This report covers the first six months of a three-year effort to compare the effectiveness of a personal computer-based aviation training device (PCATD), a flight training device (FTD), and an airplane for conducting instrument proficiency checks (IPC). During the six-month period covered by the report, we have been able to:

- Develop an IPC flight scenario and construct a standard scoring system for these flights. Four certified instrument flight instructors (CFIIs) have been trained to administer the IPCs. Additional CFIIs have been standardized to give familiarization flights in the PCATD, FTD, and airplane.
- Develop performance measurement systems for the PCATD and the FTD. The PCATD training device simulates the Sundowner aircraft and is approved by the FAA.
- Develop a training protocol to enable non-current subjects to regain proficiency.
- Update two flight data recording systems for the Sundowner aircraft.
- Recruited 146 subjects from the local area
- Began contacting subjects to schedule them for the experiment on February 11, 2002
- Began data collection
- As of March 20,2002 thirty subjects have started the study and 63 sessions have been completed. Of these 63 sessions 58 have been familiarization sessions (17 airplane, 20 PCATD and 21 FTD). There have been 6 IPC#1 sessions and 1 IPC#2 session. The subject completes the study after IPC#2.

Our research project has met all projected milestones. We had planned to begin running subjects February 7, 2002 (the adjusted date due to a delayed start date. As indicated above we started running subjects the week of February 11, 2002. The project milestones are revised to account for a September 20, 2001 start date. During the next six months, we plan to complete an additional 41 subjects in the experiment. We will also continue to develop procedures to interpret and score the information collected through the in-flight airplane performance measurement system as well as the performance systems for the PCATD and FTD.

INTRODUCTION

In order to maintain instrument currency, every six months instrument pilots must meet a recency of experience requirement by tracking courses, completing six approaches and instrument holding procedures under either simulated or actual instrument meteorological conditions (IMC). The simulated recency of experience requirements may be conducted in an airplane or an approved FTD with a Certified Flight Instructor, Instrument (CFII). If an instrument pilot fails to meet the recency of experience requirements within the six-month period, the requirements can be met within the following six months to regain instrument currency. If an instrument pilot fails to meet recency of experience requirements within a 12-month period, an instrument proficiency check (IPC) must be accomplished with a CFII for the pilot to regain instrument currency.

The specific goal of the project is to compare subject performance of an IPC performed in a PCATD, a FTD, and an airplane (IPC #1) with a second IPC in an airplane (IPC #2) to evaluate the effectiveness of the PCATD and the FTD in conducting an IPC flight. Parallel to these efforts, the project will develop and analyze performance measures derived from an airborne Flight Data Recorder (FDR) as well as from similar data from the PCATD and FTD. These measures will allow us to examine in detail various aspects of pilot performance and identify particular strengths and weaknesses associated with the particular training devices.

The study will directly compare the performance of pilots receiving an IPC in a PCATD, a Frasca FTD or an Airplane (IPC #1) with performance in an airplane (IPC #2). The comparison of performance in a PCATD to that in an airplane will investigate the effectiveness of the PCATD as a device in which to administer an IPC. Currently, the PCATD is not approved to administer IPCs. The comparison of performance in a Frasca and the airplane will determine whether the current rule to permit IPCs in a FTD is warranted. Finally, we will compare the performance of pilots receiving IPC #1 in an airplane and IPC #2 in an airplane with a second Certified flight instructor, instruments (CFII). This comparison will permit the determination of the reliability of IPCs conducted in an airplane.

Comparison of the PCATD, Frasca FTD, and airplane as an IPC platform is contingent on measures of pilot performance. In addition to the CFII scores (on the dichotomous pass/fail scale), we will evaluate the subjects' performance on the IPC in their respective devices based on objective and quantitative performance measures, derived from data recorded by the FDR or the training devices (FTD and PCATD).

A total of 105 subjects will be used (35 subjects in each group: FTD, PCATD and airplane). Each subject will receive a familiarization flight in the FTD, the PCATD and the airplane prior to being assigned to an experimental group. Following the familiarization flights, subjects will be randomly assigned to one of the three groups (FTD, PCATD and airplane) with a constraint that the three currency categories will be balanced among the groups.

The subjects will be given an IPC in their respective equipment (IPC #1) and then all subjects will be given a second IPC in the airplane (IPC #2). The subjects will be required to refrain from instrument flight following IPC #1 until IPC #2 is complete. They must also agree not to use a PCATD or a FTD for instrument training during this period. Some potential subjects who are more than two years out currency may require training to prepare them for the IPC. We will provide an average of six hours training equally distributed among the FTD, PCATD and airplane to prepare them for the IPC. Table 1 depicts the experimental design in greater detail.

Table 1: Experimental Groups and Sessions

Sessions

GROUP	Familiarization Flight	Initial IPC flight (IPC#1)	Final IPC flight (IPC#2)
Airplane	In Sundowner	IPC flight in Sundowner	IPC flight in Sundowner
Frasca	In Frasca	IPC flight in Frasca	IPC flight in Sundowne r
PCATD	In PCATD	IPC flight in PCATD	IPC flight in Sundowner

REQUIREMENTS FOR THE EXPERIMENT

In order to conduct our study, we have brought together four essential elements: the experimental team, subjects, equipment, and procedures. We use this framework to describe our progress to date.

Experimental Team

Henry L. Taylor, Tom W. Emanuel, Jr., Esa M. Rantanen and Donald A. Talleur are serving as co-principal investigators on this project. All have significant expertise in aviation research with emphasis on flight training research. Three investigators (Taylor, Emanuel and Talleur) hold commercial pilot certificates (single and multi-engine airplane land with instrument rating) and flight instructor certificates (single and multiengine airplane, land with instrument training). Rantanen holds a private pilot's certificate. Taylor will be the principal point of contact for the study. The experimental team meets once each week by conference call. An agenda is prepared and circulated in advanced and minutes of the meeting are prepared and circulated. Under the agreement of the cooperative agreement the COTR is furnished with the agenda and minutes.

Subjects

A total of 105 subjects will be used (35 subjects in each group; FTD, PCATD and airplane). Based on past experience, we expect some subjects to fail to complete the study. Consequently, we plan to recruit an additional 21 subjects above the desired 105. We expect the subjects to fall into one of three categories of instrument currency: 1) instrument current; 2) within one year of currency; and 3) outside of one year of currency but within two years of currency. Each subject will receive a familiarization flight in the FTD, the PCATD and the airplane prior to being assigned to an experimental group. A randomization process is being used to balance the order of the familiarization flights. Following the familiarization flights, subjects will be assigned to one of the three groups (FTD, PCATD and airplane) with a constraint that the three currency categories are balanced among the groups.

The following outlines a modified approach to subject assignment. Since our goal is to maximize the balance on the subject currency factor, we will recruit subject who are instrument current initially and use the table below as an assignment matrix. Each replication has the six possible assignment orders given the three experimental groups (PCATD, Frasca, Airplane). After roughly 3 full replications subject assignments, we will take a close look at how the aircraft experience factor is balancing between the three groups.

PCATD= P
Frasca= F
Airplane= A

Replication	1	2	3	4	5	6
	PFA	FAP	APF	PAF	FPA	AFP
	FAP	APF	PAF	FPA	AFP	PFA
	APF	PAF	FPA	AFP	PFA	FAP
	PAF	FPA	AFP	PFA	FAP	APF
	FPA	AFP	PFA	FAP	APF	PAF
	AFP	PFA	FAP	APF	PAF	

If the aircraft experience factor appears to be balanced at this point, then we can continue using the simple matrix above but watching the balance more carefully from that point onward.

At some point, we may run out of instrument current pilots to assign, and at this point, we can start a new matrix (the same as the above matrix) an apply it to the other types of currency group subjects as originally planned for the instrument current subjects. At the tail end of the project, it is inevitable that the matrix assignment strategy may not work and we will have to manually assign subjects to keep the n’s equal. We will address this issue when we get to it.

Subject volunteers have been be recruited within a 75-mile radius of Champaign, IL. Their participation was solicited using a mail survey which will be sent to all instrument-rated pilots in the area. A total of 267 pilots responded with a statement of interest. A Pilot Experience and Biographical Data Questionnaire (Appendix I) was mailed to the 267 instrument pilots who express interest. A total of 179 pilots returned the questionnaire which collected information about the pilot's experience and instrument currency status. Of these 179 pilots 146 are considered available. A total of 72 pilot are current, 26 are within 1 year of currency, 23 are between 1-2 years and 54 are 2 years or more. All subjects will have the option of receiving payment for flight time flown during the experiment ($10/hr.), as well as mileage costs (34.5 cents) to and from Willard Airport in Savoy, IL, where all sessions will take place.

Equipment

Two FAA approved PCATDs and one FAA approved Frasca 141 FTD with a generic single-engine, fixed gear, fixed pitch propeller performance model are being used in the study. Performance measurement systems have been developed for the PCATD and for the Frasca. The FTD is approved for instrument training towards the instrument rating, instrument recency of experience training, and IPCs as well as for administering part of the instrument rating flight test. Two 180 hp Beechcraft Sundowner aircraft (BE-C23) which have a single engine, fixed-pitch propeller, and fixed under carriage will be used as aircraft for IPC#1 and IPC#2. Two flight data recording systems for the Sundowner aircraft have been updated using the latest Wide Area Augmentation System (WAAS). A technical report entitled *IPC Data Logger (a Flight Data Recorder):Operation Manual Change 1*,(ARL-02-2/FAA –02-1) was forwarded to the COTR February 13,2002. This report described the updated system.

Procedures

All subjects are participating in a VFR familiarization flight in each of the following: FTD, PCATD and airplane. The subjects also receive a review of the aircraft systems and instrumentation in each device. Following the familiarization session, all subjects are receive a baseline IPC flight in either the FTD, PCATD and airplane (IPC#1) according to which group they are assigned. IPC#1 is flown with a CFII who acts both as a flight instructor and as an experimental observer. The IPC is a standardized test of the instrument pilot's instrument skills. The types of maneuvers, as well as completion standards for an IPC, are listed in the instrument rating practical test standards (PTS) (U.S. Department of Transportation, 1998). A flight scenario, that follows the current guidelines for the flight maneuvers required by the PTS, is used for the IPC. This scenario is used to collect baseline data and to establish the initial level of proficiency for each subject who participants in the project.

The IPC #1 flight contains seven maneuvers (VOR approach, holding pattern, steep turns, unusual altitude recovery, ILS approach and ATC procedures, communication and a partial-panel non-precision approach). The CFIIs for the IPC#1 flight use a form that was designed to facilitate the collection of three types of data (Phillips, Taylor, Lintern, Hulin, Emanuel, & Talleur, 1995). First, within each maneuver there are up to 24 variables (e.g., altitude, airspeed) which are scored as pass/fail indicating whether performance on those variables met PTS requirements. Second, the flight instructor judges whether the overall performance of the each maneuver was pass/fail. Third, the CFII records if the overall performance of the subject met the PTS for the IPC.

The instructors who administer the IPC#1 flight have been standardized on the scenario to be flown and the scoring procedure. After a period, not to exceed two weeks, all subjects fly a final IPC (IPC#2) in the aircraft to assess instrument proficiency. IPC#2which is conducted by a different CFII than IPC#1, and the CFII for IPC#2 is blind to both the group to which the subject belongs and to the subject's performance on IPC#1. In terms of maneuvers, IPC#2 is identical to IPC#1. This final session contains all required maneuvers that a pilot must satisfactorily complete in order to receive an endorsement of instrument proficiency. Completion of IPC#2 marks the end of a subject's involvement in the experiment.

RESULTS TO DATE

As of March 19,2002 a total of 30 subjects had started the study. In terms of sessions completed, there have been 18 airplane familiarization (fam) flights, 20 PCATD fam flights and 21 Frasca fam flights. Six subjects have completed the IPC # 1 flight, and 1 subject has completed the IPC #2 flight.

INSTRUCTOR STANDARDIZATION PROCEDURES

All instructors used in this project were standardized through ground training sessions and actual flight sessions. First, everyone attended a meeting were the experimental design was explained, as well as each individual instructor's role in the project. Several standardization/procedures documents were used to help accomplish this ground training (see Appendices A-H). In addition to the meetings, each instructor was familiarized with the operation of the PCATD, FTD, and Sundowner aircraft and each was standardized on procedures to be used in each device. All instructors flew the Sundowner to maintain, or regain flight proficiency. Those instructors used on the IPC sessions also flew the exact IPC profile in order to be familiarized on scoring procedures and data logger operation. Likewise, scoring procedures and logger operations were reviewed for the PCATD and FTD.

COGNITIVE TASK ANALYSIS

A cognitive task analysis (CTA) was performed to investigate the areas where check pilots would most benefit from objective student pilot performance measures, extractable from flight data recorder (FDR) data. This CTA consisted of a questionnaire, which asked the check pilots to rate each element in each segment of an instrument proficiency check (IPC) flight by its (1) difficulty to observe, (2) criticality for overall evaluation of student pilot proficiency, and (3) its sensitivity to differentiate between good and poor student pilot performance.

The data from the CTA were analyzed by computing the average rating across all respondents for each IPC flight element for each of the above criteria (i.e., difficulty, criticality, and sensitivity), as above but separately for experienced respondents (ATP rated), by averaging the ratings across the criteria, and by ranking the elements by the criteria. The preliminary results showed that while there were substantial differences between the experienced and inexperience instructors' ratings, the "top ten" elements in each category were in close agreement. The efforts to develop objective performance measures to be derived from FDR data and similar data recorded by the Frasca FTD and the PCATD will concentrate on these maneuvers and maneuver elements.

PROJECT MILESTONES

The project milestones were originally developed based on a start date of August 21, 2001. The project actual start date was September 20,2001. The project milestones are revised to reflect the start date.

PROJECT MILESTONES

Task	Date	Completed
Identify Subject Pool	January 20, 2001	X
Complete Check Pilot Standardization	January 20, 2001	X
Begin Experimental Testing	February 7, 2002	X
Interim Six Month Report	March 20, 2002	X
Interim Six Month Report	September 20, 2002	
Interim Six Month Report	March 20, 2003	
Interim Six Month Report	September 20, 2003	
Interim Six Month Report	March 20, 2004	
Complete Experimental Testing	May 20, 2004	
Prepare Data File	June 20, 2004	
Complete Analysis	July 20, 2004	
Final Report	October 31, 2004	

PROBLEMS AND SOLUTIONS

Hardware and Software

There were no hardware problems associated with the PCATDs or the Frascas, but software problems were encountered with both systems in getting the vendors to provide the performance measurement systems. The Frasca problem was the most difficult but it was completed and ready for operational use by January 25, 2002.

The Modification of the IPC Data Logger proved to be the most difficult. Several of the initial attempts were unsuccessful. Appendix K provides a detailed discussion of the modification problems. As noted earlier a technical report which documents the modifications was published and forwarded on February.

Financial

The project has received a total of $302,550 for a period through 2/25/03. The first increment of $68,383 was received September 20,2001 and the second increment of $234,166 was received 2/25/02. Prior to receipt of the second increment we had obligated $51,277 more than we had received from the FAA. The proposal indicated a need for the $302,550 through September 30,2002, based on a start date of August 21, 2001. Sine we started about one month late the current funds should be sufficient through October 31,2002. We anticipate the need to get additional funds prior to 2/25/03. We will closely monitor our expenditure rate. We are approaching the best flying weather which should continue through the October time period.

PLANNING FOR THE NEXT SIX MONTHS

We plan to complete 41 additional subjects during the next six months. We will continue to refine the performance measurement functions. We will monitor the expenditure rate closely

SUMMARY

The project got off to a good start during the first 6 months. All hardware and software problems were solved before they became limiting factors. The subject pool looks good and there are no operational problems at the present time.

Appendix A

IPC Project: IPC Check Pilot Procedures

Schedules for availability must be handed in on Monday for the following week's availability. These schedules should reach my PT mailbox by 5pm each Monday.

Your assignments will be coordinated by Mary Wilson (Director's Office). She will send out emails regularly to inform you of the subject assignments.

Plan to meet the subject at the PT entrance by Kathy's office. They will be instructed to meet you at that location. Kathy will also be aware that subjects will be meeting you near her office.

Forms for all sessions outlined below are available in the top drawer of the file cabinet in the Ready Room. The cabinet is labeled for IPC project instructor use only.

Plan to have an aircraft (usually 16R or 17R) signed out and preflighted prior to subject arrival. We have no interest in the subject's ability to preflight an aircraft but they may want to do a walk around of their own prior to flying. Allow them to do this, but remind them (if you need to) that you are PIC during the flight. If the IPC session is in the Frasca or PCATD, make sure to reserve one in anticipation of the subject's arrival

If the IPC session is to be performed in the aircraft, it is also a good idea to thoroughly check the weather prior to departure. If there is doubt about being able to finish the assigned flight tasks as programmed due to the weather, then a decision to reschedule the session is warranted. Again, this policy keeps us from losing subjects from the project.

The weather decisions for aircraft flights reside with the Instructor (safety pilot) once the flight begins. If the weather deteriorates to the point where you doubt the safe outcome, the flight should be aborted. Some subjects may be more highly qualified pilots than yourself. Regardless of they're qualifications, you are PIC and the final decision during all phases of an aircraft flight remain with you.

Although you are PIC during IPC flights in the aircraft, we would like you to act as a safety pilot only. If the need arises to give instruction or physical assistance to avoid a safety or ATC related problem, you should consider whether the subject would have been able to handle the situation on their own. If the answer to that question is no, then score accordingly for that maneuver or task element.

The Check Pilot should get the IPC flight clearance (see handout for pre-filed flight plan instructions). After instrument portion of flight begins, the subject will make all radio calls until return back to CMI. Exceptions are allowed if circumstances warrant IPC Check Pilot intervention in order clarify clearances or make special requests.

If completion of an item to be scored is not otherwise obvious to the Check Pilot, the subject should verbalize completion of that task (i.e., acknowledgement of arrival at MAP).

On occasion, a subject may perform a maneuver slightly different than we're used to seeing. Their method may be perfectly allowable in many cases. If you suspect a different method is being used than would be indicated by the task outline on the scoring form, ask the subject to explain their actions.

Maneuvers on the IPC flight must be done in order and only the maneuvers listed are to be completed. (no substitutions are allowed) Deviations from the order or content of the IPC will also result in the loss of the subject from the experimental pool.

All approaches for the IPC flight should be flown to straight-in minimums regardless of wind conditions. Speed on Final Approach is strictly at the pilot's discretion, however, it should be stabilized per PTS standards inside of the FAF.

Any flight time in the aircraft or the Frasca may include a logbook endorsement for instruction given if the subject would wants an entry. You are always entitled to log any instruction given in the aircraft in your own logbook regardless of whether or not the subject wants a logbook endorsement.

You may provide an IPC sign-off if the subject requests one after successful completion of IPC#1 or IPC#2 and the flight was completed either in the Frasca 141 or the Sundowner. You may also offer the signoff when one is warranted.

Spare headsets are available in case the subject forgets theirs or does not have one. These can be obtained from dispatch. They will be kept in the dispatch file cabinet. Alcohol swabs are also kept there and should be used to clean the ear piece of the headsets after every use. Cleaning of the headset is critical! We've had people develop serious infections from wearing other people's headsets in the past.

Remember to always record the time the subject spent flying a particular device on the forms where provided for. This record allows us to figure subject payment at the end of their involvement. Also keep track of your time spent with the subject on your own so that we can rationalize your payment for service on this project.

Both of the Research aircraft, both PCATDs in room 201 ARL and Frasca 175 are equipped with data logger automated in-flight data collection systems. The operation of this equipment is required for all IPC flights (both IPC#1 and IPC#2). General instructions for their use follows:

Aircraft:

Be sure to grab a floppy disk from the file cabinet prior to going out to the aircraft. Please be sure to write down the file name on the score sheet and file out the floppy disk label after the flight. Use only one floppy disk per flight. Place the disk and score sheets in my mailbox after each flight.

When using the data logger during an IPC flight, follow the instructions provided in each aircraft. Any discrepancies in operation of this equipment should be reported to Don Talleur immediately. An inoperative data logger does not preclude the continuation of a flight that is underway. In the case of an inop logger prior to a scheduled departure, the flight should be cancelled and the subject rescheduled.

Frasca 175:

The data recording procedure for the Frasca is slightly different that for the aircraft.
1) After system boot-up, you will see an icon on the Frasca GIST station that has two little computers with an arrow between them.
2) When ready to start the IPC session, click this icon and a window will appear that allows a file name to be entered.
3) Step 1: Click on the "Browse" button to specify the location where you want to store the data file. Select "drives" at bottom of window; then select drive F:\. Drive F will have extra words after it. Once in drive F, select "data" directory from window right above "drives" window.
4) Make a file name for the session (e.g., if it's subject #35 and they're doing IPC#1 then make a file name like 35IPC1)
5) You need not enter anything for step #2.
6) For step 3, when you're ready to start recording data, simply click the "record" button and a number to the right of that button should start counting up in the "seconds" window
7) Run the IPC session straight through without interruption. The data recording window can be minimized by clicking on the "underline" icon in the upper right hand corner. To reopen a minimized window, click on the program tab at the bottom of the GISt screen.
8) When finished with the IPC session, click on the "stop" button and then click the "done" button at the bottom of the GISt Record window.
9) Shut down the Frasca as normal

Elite PCATD:

Set up the training session as desired following the instruction sheet posted with each machine. As soon as you are ready to begin the IPC flight, select the "freeze" option to unfreeze the simulation. Data recording begins automatically. There is no further user interaction required. When finished, shut down machine following the provided instructions.

Sequence of Sessions for each subject:

Subjects WITHIN 24 months of instrument currency

1) PCATD VFR familiarization
2) Frasca 141 VFR familiarization (These three sessions will be done in
3) Sundowner VFR familiarization predetermined order)

4) IPC#1 in either PCATD, Frasca, or Aircraft (depends on group assignment)

5) IPC#2 in the Sundowner (within two weeks of IPC#1)

Subjects OUTSIDE 24 months of instrument currency

1) Proficiency Training in Frasca 141 (up to 6 hours in order to increase their instrument proficiency)

2) PCATD VFR familiarization
3) Frasca 141 VFR familiarization (These three sessions will be done in
4) Sundowner VFR familiarization a predetermined order)

5) IPC#1 in either PCATD, Frasca, or Aircraft (depends on group assignment)

6) IPC#2 in the Sundowner (within two weeks of IPC#1)

Appendix B

IPC Check Pilot Standardization: IPC Signoff Guidelines

Below are some basic guidelines to assist you in making a decision to give a subject an IPC signoff. These rules are not meant to supercede PTS guidelines, but rather supplement them since the PTS has allowances for exceeding the standards for maneuvers required during the IPC:

General- Overall Performance

1) Most scored maneuvers have tasks that specify fairly concrete parameters (such as +/- 100 ft, etc.) These task elements should be scored objectively in the sense that the subject's performance either falls within the stated limits or it does not. No subjective decision or rational should be applied to these scores.

2) At the end of each maneuver you are asked to indicate whether the maneuver, on the whole, met PTS standards. Remember that this judgement allows for the standards to be exceeded as long a) as they are not consistently exceeded and b) a prompt and correct action is taken by the subject to recover from the error.

3) The last "scoring" item is if you feel the subject's performance deserves an IPC signoff. This is the most subjective decision that you will make during the session. Remember to make your decision by referencing what is safe, legally allowable, and accepted practice in terms of performance. Also use the guidelines below to help determine how closely the PTS should be followed when making an IPC signoff decision.

4) In terms of overall performance, there are a few areas that are immediately disqualifying:

a) failure to realize a missed approach is needed (due to full scale deflection of CDI inside of FAF, etc.)

b) inability to communicate on the radios; however, a subject may miss a few radio calls due to unfamiliarity with the call sign. You may prompt them that they've missed a call. At that point they should be able to handle the call without assistance. Incorrect readbacks to ATC followed by correct action on the pilot's part should not immediately disqualify them. Making these types of errors **consistently** is grounds for disqualification. Non-compliance with an ATC clearance or request will be disqualifying if the error would clearly lead to a possible violation or put flight safety at risk.

c) consistent busting of altitudes, MDA, or level off is disqualifying; however, infrequent deviations from PTS is allowed in most areas as long as timely corrections are made.

d) failure to identify the MAP within safe limits: this means within the context of the approach being flown and surrounding terrain or obstructions.

5) A statement from the pilot indicating reasons for doing a maneuver, or part of a maneuver, in a manner different from what we normally expect is acceptable as long as there is no legal or safety issue. Do not confuse technique with ability to perform a maneuver safely within legal limits.

6) Leeway should be given if unusual environmental circumstance exist: i.e., turbulence, high winds, windshear. It should be clear that most pilots will not venture into certain weather conditions while flying solo. However, with us onboard, they may agree to fly in conditions that are beyond their ability. Every effort should be made to determine if the pilot is comfortable with the weather conditions. In general if you are doubtful about the "average" pilot's ability to handle the current weather, you should have the session rescheduled. If you would not do a training flight with an AVI 130 in the current conditions, you should seriously consider whether you want to do it with our subjects.

VOR Approach

1) Pilot must perform some sort of procedure turn (PT) on the barbed PT side of the FAC.
2) Pilot must make a decent from FAF to MDA in order to arrive at the MDA by the time they reach the MAP. Being higher than necessary crossing FAF is not immediately disqualifying unless they fail to descend **safely.** They must be in control of whatever descent they perform.
3) Timing from FAF to MAP is not required if they are using an alternate, and acceptable, means to identify MAP.
4) Deviations below MDA of around 20 ft are allowed as long as prompt action is taken by the pilot to return to MDA. 20 ft. is within the resolution of the altimeter readout.
5) Deviations above MDA are allowed and not limited to a specific altitude; however, if they exceed 100 ft they should have a good reason for doing so.
6) Deviations beyond ¾ scale CDI deflection are allowed at anytime along the FAC as long as the error is infrequent and the pilot sees the need, and applies, a correction appropriate to the deviation.

Holding Pattern

Note: The altitude at which we hold is usually part of a block altitude clearance. The pilot may be unfamiliar with this, so you should tell them what altitude they are expected to maintain.

1) Pilot must stay in protected airspace at all times. Remember that this is a large area around the holding fix.
2) Pilot must be able to enter the hold in some manner consistent with staying in protected airspace. Remember that the standard holding entry procedures are recommended and are not regulatory.
3) Pilot may identify the fix either by DME or crossing radials as charted.
4) Pilot should know where they are relative to the holding fix at all times.
5) Accurate timing is not a requirement as along as a lack of timing does not lead to disorientation in the pattern or would lead to busting protected airspace, but whatever timing strategy is used should result in an inbound leg which at least approaches the specified inbound timing.
6) Corrections to return to the inbound course (if off -course) so as to be within full scale CDI deflection prior to crossing over the holding fix is required. However, the pilot should not consistently need to correct from full scale deflection on each inbound leg.
7) Altitude deviations from PTS are allowed as long as they are infrequent and the pilot makes corrections to return to the desired altitude.

Steep Turn

1) Deviations from altitude and airspeed are allowed but prompt correction should be made if an error does occur.
2) Pilot must be able to rollout from turn and be restabilized in straight and level flight within 10-15 sec.
3) Pilot must be in control of the aircraft with no serious doubt about the outcome of the maneuver. In other words, an unusual attitude resulting from a failed attempt at the steep turn would be disqualifying.

Unusual Attitude

1) Deviation from the standard recovery procedure (order) is allowed as long as the pilot is in control of the aircraft and a return to steady state is accomplished in a timely manner.

ILS Approach

1) Pilot should be able to intercept course from ATC vector and become established inbound prior to reaching FAF. One constraint placed on their ability to accomplish this is the quality of ATC vectors. Take that into account, but bear in mind that the pilot should probably realize when ATC is providing inadequate vectors.
2) Once established, full scale deflection is allowed outside of the FAF only if the pilot realizes the error and is in the process of correcting.
3) Proper glideslope interception is at the Initial Approach Altitude (IAA) as charted, however, the pilot may intercept the glideslope form any altitude above IAA and track it to the FAF.

4) If the Glideslope is full scale at FAF the maneuver is failed and the pilot should indicate the need to execute a missed approach.
5) During Final descent on the glideslope, the pilot needs to stay within full scale deflection at all times while tracking both the localizer and glideslope. Consistent deviations to ¾ scale (or beyond) is disqualifying.
6) The pilot should recognize the need to look up and then execute a miss upon reaching the DH.
7) Timing is not a requirement for the ILS

VOR Partial Panel Approach

1) Pilot should be able to fly approach partial panel from established inbound on the FAC within 10 miles all the way to MAP or until you need to take over for the landing.
2) Pilot must make a decent from FAF to MDA in order to arrive at the MDA by the time they reach the MAP. Being higher than necessary crossing FAF is not immediately disqualifying unless they fail to descend **safely.** They must be in control of whatever descent they perform.
3) Timing from FAF to MAP is not required if they are using an alternate means to identify MAP.
4) Deviations below MDA exceeding 20 ft, and any deviation below MDA without timely correction are disqualifying.
5) Deviations above MDA are allowed and not limited to a specific altitude; however, if they exceed 100 ft they should have a good reason for doing so.
6) Deviations beyond ¾ scale CDI deflection are allowed at anytime along the FAC as long as the error is infrequent and the pilot sees the need, and applies, a correction appropriate to the deviation.

ATC Communications

1) Pilots will be familiar with the radios prior to the IPC so they can be expected to set their own radios. However, since they will be given familiarity training on three different radio racks (Aircraft, FTD, and PCATD), the pilot may still require some minor assistance with radio setup. Pilots should indicate that they know what should be set in the radios prior to the check pilot assisting. The pilot should verbally prompt the check pilot when they need assistance and, in those cases, they should inform the check pilot what they would like set on the radios. This is not an excuse to use the check pilot in a "co-pilot" capacity!

2) Pilots are responsible for listening for ATC clearances and reading them back. Some unfamiliarity with local operating practices will be observed from time to time however. In these cases, the pilot should be coached to have ATC repeat or verify any unclear ATC communications. Some problems also occur because the pilot is not used to listening for any call sign but their own. Try to determine if their inability to handle the communications tasks are due to call sign unfamiliarity or simply being overloaded with the flight tasks. If they're overloaded and fail to handle the ATC communications, then this task should be recorded as a failure.

Appendix C

IPC Project: Instructor Procedures

Schedules for availability must be handed in on Monday for the following week's availability. These schedules should reach my PT mailbox by 5pm each Monday.

Your assignments will be coordinated by Mary Wilson (Director's Office). She will send out emails regularly to inform you of the subject assignments.

Plan to meet the subject at the PT entrance by Kathy's office. They will be instructed to meet you at that location. Kathy will also be aware that subjects will be meeting you near her office.

Forms for all sessions outlined below are available in the top drawer of the file cabinet in the Ready Room. The cabinet is labeled for IPC project instructor use only.

All first time subjects are required to fill out a three-page consent/payment packet. This packet can be obtained from the ready room file cabinet.

Some subjects will be scheduled for proficiency training in order to become instrument current. These sessions are completed in the Frasca 141 (any of the four 141s). A form describing procedures to complete these sessions is in the ready room file cabinet. Proficiency training may continue over several sessions (not to exceed 6 hours) in order to get the subject's performance up to par in order to pass the IPC. When a subject's proficiency is to the point where they have a reasonable chance of passing an IPC, they are ready to start with the VFR familiarization sessions.

Talleur will have a file in the Ready Room file cabinet (Drawer marked IPC Project) for each subject that has not yet completed the proficiency in the Frasca. Add notes to this form as necessary for the next instructor who may have to work with the subject.

Subjects who complete proficiency training will be given a mandatory delay prior to starting any additional sessions in order to preclude biasing their performance on the IPC flights.

Most subjects will start their involvement with us by doing the Sundowner/PCATD/Frasca VFR Familiarization Session: Use form provided for this session to assure that required tasks are completed. You will be informed which device to use for the scheduled session. Each subject will do the same VFR familiarization in each of the three devices; however, subjects will not always fly these three devices in the same sequence. At the completion of each of these sessions, hand in the completed form to Don Talleur. You may provide whatever instructional feedback you think is necessary either during or after the session. A logbook endorsement attesting to their completion of this currency requirement is not mandatory but should be offered.

The weather decisions for aircraft flights reside with the Instructor (safety pilot) once the flight begins. If the weather deteriorates to the point where you doubt the safe outcome, the flight should be aborted. Some subjects may be more highly qualified pilots than yourself. Regardless of their qualifications, you are PIC and the final decision during all phases of an aircraft flight remain with you.

Do not assume that the subject is familiar with the aircraft or other simulation device. Use the same vigilance as you would with a new student. However, do be gentle in your instruction to these subjects if they have trouble getting adjusted to the device. Remember that they are volunteers and can quit at any time they like with no personal loss and will still receive full pay for time completed in the project.

Any flight time in the aircraft or the Frasca may include a logbook endorsement for instruction given if the subject would wants an entry. You are always entitled to log any instruction given in the aircraft in your own logbook regardless of whether or not the subject wants a logbook endorsement.

Spare headsets are available in case the subject forgets theirs or does not have one. These can be obtained from dispatch. They will be kept in the dispatch file cabinet. Alcohol swabs are also kept there and should be used to clean the ear piece of the headsets after every use. Cleaning of the headset is critical! We've had people develop serious infections from wearing other people's headsets in the past.

Remember to always record the time the subject spent flying a particular device on the forms where provided for. This record allows us to figure subject payment at the end of their involvement. Also keep track of your time spent with the subject on your own so that we can rationalize your payment for service on this project.

Both of the Research aircraft are being equipped with data logger automated in-flight data collection systems. The operation of this equipment is not pertinent to any of your flights and should remain turned off for the duration of any training flights.

Sequence of Sessions for each subject:

Subjects WITHIN 24 months of instrument currency

1) PCATD VFR familiarization
2) Frasca 141 VFR familiarization (These three sessions will be done in predetermined order)
3) Sundowner VFR familiarization

4) IPC#1 in either PCATD, Frasca, or Aircraft (depends on group assignment)

5) IPC#2 in the Sundowner (within two weeks of IPC#1)

Subjects OUTSIDE 24 months of instrument currency

1) Proficiency Training in Frasca 141 (up to 6 hours in order to increase their instrument proficiency)

2) PCATD VFR familiarization
3) Frasca 141 VFR familiarization (These three sessions will be done in a predetermined order)
4) Sundowner VFR familiarization

5) IPC#1 in either PCATD, Frasca, or Aircraft (depends on group assignment)

6) IPC#2 in the Sundowner (within two weeks of IPC#1)

Appendix D

IPC 1- Aircraft Form

Instructor______________________ **Date____________ Subject Number_________**
Data logger File Name:___________________

On taxi out:	**Completed:**
Instrument Check during taxi	_______

VOR Approach (DEC VOR 36 Via PT)
Please test the VOR approach first during the flight. Check "yes" or "no" to indicate whether the subject's performance met the criteria.

Task	Yes	No
1) VOR 36 Course Intercept		
Tune, Ident VOR	_____	_____
Set Proper Outbound Course	_____	_____
Properly Intercepts Course	_____	_____
Altitude $\pm$100	_____	_____
2) VOR 36 Outbound Tracking		
Less Than Full-Scale CDI Deflection	_____	_____
Altitude $\pm$100 ft (When holding constant altitude)	_____	_____
Heading $\pm 10^{o}$	_____	_____
3) VOR 36 Procedure Turn		
Executes Proper Procedure Turn (Correct direction)	_____	_____
Altitude $\pm$100 ft (When holding constant altitude)	_____	_____
Heading $\pm 10^{o}$	_____	_____
Uses Proper Timing	_____	_____
Stays within 10nm of DEC VOR during PT	_____	_____
Resets OBS to Inbound Course (If applicable)	_____	_____
Correctly intercept FAC from inbound leg of PT	_____	_____
4) VOR 36 Inbound Tracking to FAF		
Less Than Full-Scale CDI Deflection	_____	_____
Altitude $\pm$100 ft (When holding constant altitude)	_____	_____
Heading $\pm 10^{o}$	_____	_____
Identifies FAF	_____	_____
Starts Descent at FAF	_____	_____
Starts Time (as necessary)	_____	_____
5) VOR 36 Final Approach Segment to MAP		
Less Than 3/4 Scale CDI Deflection	_____	_____
Airspeed $\pm$10 kts	_____	_____
Maintains MDA +100/-0 ft	_____	_____
Properly Identifies MAP (Time or DME reference)	_____	_____
Meets Practical Test Standards	_____	_____

Instructor______________________ Date___________ Subject Number_______ IPC 1

Holding Procedures (HASSE) – **Entry and 2 full turns**
Please test the holding pattern second during the flight. Check "yes" or "no" to indicate whether the subject's performance met the criteria.

6) Holding Pattern Entry

Measure	Desired	Yes	No
Tune and Ident Proper Navaids		_____	_____
Sets Proper Course(s) in OBS		_____	_____
Recognizes Arrival at Holding Fix		_____	_____
Initiates Prompt Entry		_____	_____
Uses Recommended Entry Procedure		_____	_____
Properly Reports Entry		_____	_____
From Initial Arrival at Holding Fix to Crossing Fix on 1st Inbound Leg			
Airspeed	$\pm$10 kts	_____	_____
Altitude	$\pm$100 ft	_____	_____
On Inbound Leg			
Maintains Desired Course	$\pm 10^{o}$	_____	_____
Applies Proper Timing		_____	_____

First Full Holding Pattern

Measure	Desired	Yes	No
On Outbound Leg:			
Maintains appropriate Wind Correction		_____	_____
Applies Proper Timing		_____	_____
On Inbound Leg:			
Maintains Desired Course	$\pm 10^{o}$	_____	_____
Throughout Pattern:			
Airspeed	$\pm$10 kts	_____	_____
Altitude	$\pm$100 ft	_____	_____

Second Full Holding Pattern

Measure	Desired	Yes	No
On Outbound Leg:			
Maintains appropriate Wind Correction		_____	_____
Applies Proper Timing		_____	_____
On Inbound Leg:			
Maintains Desired Course	$\pm 10^{o}$	_____	_____
Throughout Pattern:			
Airspeed	$\pm$10 kts	_____	_____
Altitude	$\pm$100 ft	_____	_____

Meets Practical Test Standards		_____	_____

Instructor______________________ Date___________ Subject Number________ IPC 1

Steep Turns

Please test steep turns third during the flight; one 360^o turn to the left and one 360^o turn to the right. Check "yes" or "no" to indicate whether the performance met the criteria.

Measure	Desired	Yes	No
7) Left 360^o Steep Turn			
Altitude	$\pm$100 ft	_____	_____
Airspeed	$\pm$10 kts	_____	_____
Bank Angle	$\pm 5^o$	_____	_____
8) Right 360^o Steep Turn			
Altitude	$\pm$100 ft	_____	_____
Airspeed	$\pm$10 kts	_____	_____
Bank Angle	$\pm 5^o$	_____	_____
Meets Practical Test Standards		_____	_____

Instructor______________________ Date___________ Subject Number________ IPC 1

Unusual Attitude Recovery

Please test one unusual attitude recovery immediately after the steep turns. Check “yes” or “no to indicate whether the subject’s performance met the criteria.

Task	Yes	No
Applies in appropriate order, **Bank, Pitch** and **Power** in a timely fashion during recovery.	_____	_____

ILS Approach (DEC ILS 6 Via RV)

Please test the ILS approach last while at Decatur. Check "yes" or "no" to indicate whether the subject’s performance met the criteria.

Task	Yes	No
9) ILS 6 Intercept (RV to the FAC)		
Tune, Ident Localizer	_____	_____
Identifies Proper Course	_____	_____
Altitude $\pm$100	_____	_____
10) ILS 6 Inbound Tracking to FAF		
Less Than Full-Scale CDI Deflection	_____	_____
Altitude $\pm$100 ft (When holding constant altitude)	_____	_____
Heading $\pm 10^{o}$	_____	_____
Starts Time at FAF	_____	_____
Properly Intercepts Glide Slope	_____	_____
11) ILS 6 Final Approach Segment:		
Less Than 3/4 Scale CDI Deflection	_____	_____
Less Than 3/4 Scale Glide Slope Deflection	_____	_____
Airspeed $\pm$10 kts	_____	_____
Properly Identifies MAP	_____	_____
Meets Practical Test Standards	_____	_____

Instructor_____________________ **Date___________** **Subject Number________** **IPC 1**

Partial Panel VOR Approach via Radar Vectors (Name of Approach _______________)
Please test a partial panel VOR approach during return to CMI. Check "yes" or "no" to indicate whether the subject's performance met the criteria.

Task	Yes	No
12) VOR Approach Intercept		
Tune, Ident VOR	_____	_____
Set Proper Course	_____	_____
Properly intercepts course	_____	_____
Altitude $\pm$100	_____	_____
13) VOR Approach Inbound Tracking to FAF		
Less Than Full-Scale CDI Deflection	_____	_____
Altitude $\pm$100 ft (When holding constant altitude)	_____	_____
Heading $\pm 10^{o}$	_____	_____
Identifies FAF	_____	_____
Starts Descent From FAF or as Appropriate	_____	_____
14) VOR Approach Final Approach Segment to MAP		
Less Than 3/4 Scale CDI Deflection	_____	_____
Airspeed $\pm$10 kts	_____	_____
Maintains MDA +100/-0 ft	_____	_____
Properly Identifies MAP	_____	_____
Meets Practical Test Standards	______	______

ATC Procedures/ Communications
Please monitor the subject's ATC procedures and communications throughout the flight. Check "yes" or "no to indicate whether the subject's performance met the criteria.

Task	Yes	No
Subject used appropriate ATC procedures and Communications during the flight	_____	_____

Please indicate the Hobbs time logged on this flight ___________

Did you give an IPC signoff (based on current PTS requirements) **YES** **NO** (circle one)

Appendix E

IPC 1- Frasca Form

Instructor______________________ Date___________ Subject Number________
Data logger File Name:__________________

VOR Approach (DEC VOR 36 Via PT)
Please test the VOR approach first during the flight. Check "yes" or "no" to indicate whether the subject's performance met the criteria.

Task	Yes	No
1) VOR 36 Course Intercept		
Tune, Ident VOR	_____	_____
Set Proper Outbound Course	_____	_____
Properly Intercepts Course	_____	_____
Altitude ±100	_____	_____
2) VOR 36 Outbound Tracking		
Less Than Full-Scale CDI Deflection	_____	_____
Altitude ±100 ft (When holding constant altitude)	_____	_____
Heading ±10 ^{o}	_____	_____
3) VOR 36 Procedure Turn		
Executes Proper Procedure Turn (Correct direction)	_____	_____
Altitude ±100 ft (When holding constant altitude)	_____	_____
Heading ±10 ^{o}	_____	_____
Uses Proper Timing	_____	_____
Stays within 10nm of DEC VOR during PT	_____	_____
Resets OBS to Inbound Course (If applicable)	_____	_____
Correctly intercept FAC from inbound leg of PT	_____	_____
4) VOR 36 Inbound Tracking to FAF		
Less Than Full-Scale CDI Deflection	_____	_____
Altitude ±100 ft (When holding constant altitude)	_____	_____
Heading ±10 ^{o}	_____	_____
Identifies FAF	_____	_____
Starts Descent at FAF	_____	_____
Starts Time (as necessary)	_____	_____
5) VOR 36 Final Approach Segment to MAP		
Less Than 3/4 Scale CDI Deflection	_____	_____
Airspeed ±10 kts	_____	_____
Maintains MDA +100/-0 ft	_____	_____
Properly Identifies MAP (Time or DME reference)	_____	_____
Meets Practical Test Standards	_____	_____

Instructor______________________ Date____________ Subject Number________ IPC 1

Holding Procedures (HASSE) – **Entry and 2 full turns**
Please test the holding pattern second during the flight. Check "yes" or "no" to indicate whether the subject's performance met the criteria.

6) Holding Pattern Entry

Measure	Desired	Yes	No
Tune and Ident Proper Navaids		_____	_____
Sets Proper Course(s) in OBS		_____	_____
Recognizes Arrival at Holding Fix		_____	_____
Initiates Prompt Entry		_____	_____
Uses Recommended Entry Procedure		_____	_____
Properly Reports Entry		_____	_____
From Initial Arrival at Holding Fix to Crossing Fix on 1st Inbound Leg			
Airspeed	$\pm$10 kts	_____	_____
Altitude	$\pm$100 ft	_____	_____
On Inbound Leg			
Maintains Desired Course	$\pm 10^{o}$	_____	_____
Applies Proper Timing		_____	_____

First Full Holding Pattern

Measure	Desired	Yes	No
On Outbound Leg:			
Maintains appropriate Wind Correction		_____	_____
Applies Proper Timing		_____	_____
On Inbound Leg:			
Maintains Desired Course	$\pm 10^{o}$	_____	_____
Throughout Pattern:			
Airspeed	$\pm$10 kts	_____	_____
Altitude	$\pm$100 ft	_____	_____

Second Full Holding Pattern

Measure	Desired	Yes	No
On Outbound Leg:			
Maintains appropriate Wind Correction		_____	_____
Applies Proper Timing		_____	_____
On Inbound Leg:			
Maintains Desired Course	$\pm 10^{o}$	_____	_____
Throughout Pattern:			
Airspeed	$\pm$10 kts	_____	_____
Altitude	$\pm$100 ft	_____	_____
Meets Practical Test Standards		_____	_____

Instructor______________________ Date___________ Subject Number________ IPC 1

Steep Turns

Please test steep turns third during the flight; one 360^o turn to the left and one 360^o turn to the right. Check "yes" or "no" to indicate whether the performance met the criteria.

Measure	Desired	Yes	No
7) Left 360^o Steep Turn			
Altitude	$\pm$100 ft	_____	_____
Airspeed	$\pm$10 kts	_____	_____
Bank Angle	$\pm 5^o$	_____	_____
8) Right 360^o Steep Turn			
Altitude	$\pm$100 ft	_____	_____
Airspeed	$\pm$10 kts	_____	_____
Bank Angle	$\pm 5^o$	_____	_____
Meets Practical Test Standards		_____	_____

Instructor______________________ **Date___________ Subject Number________ IPC 1**

Unusual Attitude Recovery

Please test one unusual attitude recovery immediately after the steep turns. Check “yes” or “no to indicate whether the subject’s performance met the criteria.

Task	Yes	No
Applies in appropriate order, **Bank, Pitch** and **Power** in a timely fashion during recovery.	_____	_____

ILS Approach (DEC ILS 6 Via RV)

Please test the ILS approach last while at Decatur. Check "yes" or "no" to indicate whether the subject’s performance met the criteria.

Task	Yes	No
9) ILS 6 Intercept (RV to the FAC)		
Tune, Ident Localizer	_____	_____
Identifies Proper Course	_____	_____
Altitude $\pm$100	_____	_____
10) ILS 6 Inbound Tracking to FAF		
Less Than Full-Scale CDI Deflection	_____	_____
Altitude $\pm$100 ft (When holding constant altitude)	_____	_____
Heading $\pm 10^{o}$	_____	_____
Starts Time at FAF	_____	_____
Properly Intercepts Glide Slope	_____	_____
11) ILS 6 Final Approach Segment:		
Less Than 3/4 Scale CDI Deflection	_____	_____
Less Than 3/4 Scale Glide Slope Deflection	_____	_____
Airspeed $\pm$10 kts	_____	_____
Properly Identifies MAP	_____	_____
Meets Practical Test Standards	_____	_____

Instructor_____________________ Date___________ Subject Number________ IPC 1

Partial Panel VOR Approach via Radar Vectors (Name of Approach _______________)
Please test a partial panel VOR approach during return to CMI. Check "yes" or "no" to indicate whether the subject's performance met the criteria.

Task	Yes	No
12) VOR Approach Intercept		
Tune, Ident VOR	_____	_____
Set Proper Course	_____	_____
Properly intercepts course	_____	_____
Altitude $\pm$100	_____	_____
13) VOR Approach Inbound Tracking to FAF		
Less Than Full-Scale CDI Deflection	_____	_____
Altitude $\pm$100 ft (When holding constant altitude)	_____	_____
Heading $\pm 10^{o}$	_____	_____
Identifies FAF	_____	_____
Starts Descent From FAF or as Appropriate	_____	_____
14) VOR Approach Final Approach Segment to MAP		
Less Than 3/4 Scale CDI Deflection	_____	_____
Airspeed $\pm$10 kts	_____	_____
Maintains MDA +100/-0 ft	_____	_____
Properly Identifies MAP	_____	_____
Meets Practical Test Standards	_____	_____

ATC Procedures/ Communications
Please monitor the subject's ATC procedures and communications throughout the flight. Check "yes" or "no to indicate whether the subject's performance met the criteria.

Task	Yes	No
Subject used appropriate ATC procedures and Communications during the flight	_____	_____

Please indicate the Hobbs time logged on this flight ___________

Appendix F

IPC 1- PCATD Form

Instructor____________________ Date___________ Subject Number________
Data logger File Name:__________________

VOR Approach (DEC VOR 36 Via PT)
Please test the VOR approach first during the flight. Check "yes" or "no" to indicate whether the subject's performance met the criteria.

Task	Yes	No
1) VOR 36 Course Intercept		
Tune, Ident VOR	_____	_____
Set Proper Outbound Course	_____	_____
Properly Intercepts Course	_____	_____
Altitude $\pm$100	_____	_____
2) VOR 36 Outbound Tracking		
Less Than Full-Scale CDI Deflection	_____	_____
Altitude $\pm$100 ft (When holding constant altitude)	_____	_____
Heading $\pm 10^{o}$	_____	_____
3) VOR 36 Procedure Turn		
Executes Proper Procedure Turn (Correct direction)	_____	_____
Altitude $\pm$100 ft (When holding constant altitude)	_____	_____
Heading $\pm 10^{o}$	_____	_____
Uses Proper Timing	_____	_____
Stays within 10nm of DEC VOR during PT	_____	_____
Resets OBS to Inbound Course (If applicable)	_____	_____
Correctly intercept FAC from inbound leg of PT	_____	_____
4) VOR 36 Inbound Tracking to FAF		
Less Than Full-Scale CDI Deflection	_____	_____
Altitude $\pm$100 ft (When holding constant altitude)	_____	_____
Heading $\pm 10^{o}$	_____	_____
Identifies FAF	_____	_____
Starts Descent at FAF	_____	_____
Starts Time (as necessary)	_____	_____
5) VOR 36 Final Approach Segment to MAP		
Less Than 3/4 Scale CDI Deflection	_____	_____
Airspeed $\pm$10 kts	_____	_____
Maintains MDA +100/-0 ft	_____	_____
Properly Identifies MAP (Time or DME reference)	_____	_____
Meets Practical Test Standards	_____	_____

Instructor______________________ Date____________ Subject Number_______ IPC 1

Holding Procedures (HASSE) – **Entry and 2 full turns**
Please test the holding pattern second during the flight. Check "yes" or "no" to indicate whether the subject's performance met the criteria.

6) Holding Pattern Entry

Measure	Desired	Yes	No
Tune and Ident Proper Navaids		_____	_____
Sets Proper Course(s) in OBS		_____	_____
Recognizes Arrival at Holding Fix		_____	_____
Initiates Prompt Entry		_____	_____
Uses Recommended Entry Procedure		_____	_____
Properly Reports Entry		_____	_____
From Initial Arrival at Holding Fix to Crossing Fix on 1st Inbound Leg			
Airspeed	±10 kts	_____	_____
Altitude	±100 ft	_____	_____
On Inbound Leg			
Maintains Desired Course	$\pm 10^{o}$	_____	_____
Applies Proper Timing		_____	_____

First Full Holding Pattern

Measure	Desired	Yes	No
On Outbound Leg:			
Maintains appropriate Wind Correction		_____	_____
Applies Proper Timing		_____	_____
On Inbound Leg:			
Maintains Desired Course	$\pm 10^{o}$	_____	_____
Throughout Pattern:			
Airspeed	±10 kts	_____	_____
Altitude	±100 ft	_____	_____

Second Full Holding Pattern

Measure	Desired	Yes	No
On Outbound Leg:			
Maintains appropriate Wind Correction		_____	_____
Applies Proper Timing		_____	_____
On Inbound Leg:			
Maintains Desired Course	$\pm 10^{o}$	_____	_____
Throughout Pattern:			
Airspeed	±10 kts	_____	_____
Altitude	±100 ft	_____	_____

Meets Practical Test Standards		_____	_____

Instructor______________________ Date___________ Subject Number________ IPC 1

Steep Turns

Please test steep turns third during the flight; one 360^{o} turn to the left and one 360^{o} turn to the right. Check "yes" or "no" to indicate whether the performance met the criteria.

Measure	Desired	Yes	No
7) Left 360^{o} Steep Turn			
Altitude	$\pm$100 ft	_____	_____
Airspeed	$\pm$10 kts	_____	_____
Bank Angle	$\pm 5^{o}$	_____	_____
8) Right 360^{o} Steep Turn			
Altitude	$\pm$100 ft	_____	_____
Airspeed	$\pm$10 kts	_____	_____
Bank Angle	$\pm 5^{o}$	_____	_____
Meets Practical Test Standards		_____	_____

Instructor______________________ Date___________ Subject Number________ IPC 1

Unusual Attitude Recovery

Please test one unusual attitude recovery immediately after the steep turns. Check “yes” or “no to indicate whether the subject’s performance met the criteria.

Task	Yes	No
Applies in appropriate order, **Bank, Pitch** and **Power** in a timely fashion during recovery.	_____	_____

ILS Approach (DEC ILS 6 Via RV)

Please test the ILS approach last while at Decatur. Check "yes" or "no" to indicate whether the subject’s performance met the criteria.

Task	Yes	No
9) ILS 6 Intercept (RV to the FAC)		
Tune, Ident Localizer	_____	_____
Identifies Proper Course	_____	_____
Altitude $\pm$100	_____	_____
10) ILS 6 Inbound Tracking to FAF		
Less Than Full-Scale CDI Deflection	_____	_____
Altitude $\pm$100 ft (When holding constant altitude)	_____	_____
Heading $\pm 10^{o}$	_____	_____
Starts Time at FAF	_____	_____
Properly Intercepts Glide Slope	_____	_____
11) ILS 6 Final Approach Segment:		
Less Than 3/4 Scale CDI Deflection	_____	_____
Less Than 3/4 Scale Glide Slope Deflection	_____	_____
Airspeed $\pm$10 kts	_____	_____
Properly Identifies MAP	_____	_____
Meets Practical Test Standards	_____	_____

Instructor______________________ Date___________ Subject Number________ IPC 1

Partial Panel VOR Approach via Radar Vectors (Name of Approach ________________)
Please test a partial panel VOR approach during return to CMI. Check "yes" or "no" to indicate whether the subject's performance met the criteria.

Task	Yes	No
12) VOR Approach Intercept		
Tune, Ident VOR	_____	_____
Set Proper Course	_____	_____
Properly intercepts course	_____	_____
Altitude ±100	_____	_____
13) VOR Approach Inbound Tracking to FAF		
Less Than Full-Scale CDI Deflection	_____	_____
Altitude ±100 ft (When holding constant altitude)	_____	_____
Heading ±10^{o}	_____	_____
Identifies FAF	_____	_____
Starts Descent From FAF or as Appropriate	_____	_____
14) VOR Approach Final Approach Segment to MAP		
Less Than 3/4 Scale CDI Deflection	_____	_____
Airspeed ±10 kts	_____	_____
Maintains MDA +100/-0 ft	_____	_____
Properly Identifies MAP	_____	_____
Meets Practical Test Standards	______	______

ATC Procedures/ Communications
Please monitor the subject's ATC procedures and communications throughout the flight. Check "yes" or "no to indicate whether the subject's performance met the criteria.

Task	Yes	No
Subject used appropriate ATC procedures and Communications during the flight	_____	_____

Please indicate the Hobbs time logged on this flight ___________

Did you give an IPC signoff (based on current PTS requirements) to this subject if this device were approved for giving IPCs **YES** **NO** (circle one)

Appendix G

IPC 2- Aircraft Form

Instructor______________________ Date___________ Subject Number________
Data logger File Name:__________________

On taxi out: **Completed:**

Instrument Check during taxi ______

VOR Approach (DEC VOR 36 Via PT)
Please test the VOR approach first during the flight. Check "yes" or "no" to indicate whether the subject's performance met the criteria.

Task	Yes	No
1) VOR 36 Course Intercept		
Tune, Ident VOR	_____	_____
Set Proper Outbound Course	_____	_____
Properly Intercepts Course	_____	_____
Altitude $\pm$100	_____	_____
2) VOR 36 Outbound Tracking		
Less Than Full-Scale CDI Deflection	_____	_____
Altitude $\pm$100 ft (When holding constant altitude)	_____	_____
Heading $\pm 10^{o}$	_____	_____
3) VOR 36 Procedure Turn		
Executes Proper Procedure Turn (Correct direction)	_____	_____
Altitude $\pm$100 ft (When holding constant altitude)	_____	_____
Heading $\pm 10^{o}$	_____	_____
Uses Proper Timing	_____	_____
Stays within 10nm of DEC VOR during PT	_____	_____
Resets OBS to Inbound Course (If applicable)	_____	_____
Correctly intercept FAC from inbound leg of PT	_____	_____
4) VOR 36 Inbound Tracking to FAF		
Less Than Full-Scale CDI Deflection	_____	_____
Altitude $\pm$100 ft (When holding constant altitude)	_____	_____
Heading $\pm 10^{o}$	_____	_____
Identifies FAF	_____	_____
Starts Descent at FAF	_____	_____
Starts Time (as necessary)	_____	_____
5) VOR 36 Final Approach Segment to MAP		
Less Than 3/4 Scale CDI Deflection	_____	_____
Airspeed $\pm$10 kts	_____	_____
Maintains MDA +100/-0 ft	_____	_____
Properly Identifies MAP (Time or DME reference)	_____	_____
Meets Practical Test Standards	_____	_____

Instructor______________________ **Date**___________ **Subject Number**_______ **IPC 2**

Holding Procedures (HASSE) – **Entry and 2 full turns**
Please test the holding pattern second during the flight. Check "yes" or "no" to indicate whether the subject's performance met the criteria.

6) Holding Pattern Entry

Measure	Desired	Yes	No
Tune and Ident Proper Navaids		_____	_____
Sets Proper Course(s) in OBS		_____	_____
Recognizes Arrival at Holding Fix		_____	_____
Initiates Prompt Entry		_____	_____
Uses Recommended Entry Procedure		_____	_____
Properly Reports Entry		_____	_____
From Initial Arrival at Holding Fix to Crossing Fix on 1st Inbound Leg			
Airspeed	$\pm$10 kts	_____	_____
Altitude	$\pm$100 ft	_____	_____
On Inbound Leg			
Maintains Desired Course	$\pm 10^{o}$	_____	_____
Applies Proper Timing		_____	_____

First Full Holding Pattern

Measure	Desired	Yes	No
On Outbound Leg:			
Maintains appropriate Wind Correction		_____	_____
Applies Proper Timing		_____	_____
On Inbound Leg:			
Maintains Desired Course	$\pm 10^{o}$	_____	_____
Throughout Pattern:			
Airspeed	$\pm$10 kts	_____	_____
Altitude	$\pm$100 ft	_____	_____

Second Full Holding Pattern

Measure	Desired	Yes	No
On Outbound Leg:			
Maintains appropriate Wind Correction		_____	_____
Applies Proper Timing		_____	_____
On Inbound Leg:			
Maintains Desired Course	$\pm 10^{o}$	_____	_____
Throughout Pattern:			
Airspeed	$\pm$10 kts	_____	_____
Altitude	$\pm$100 ft	_____	_____

Meets Practical Test Standards _____ _____

Instructor______________________ **Date___________ Subject Number________ IPC 2**

Steep Turns

Please test steep turns third during the flight; one 360^o turn to the left and one 360^o turn to the right. Check "yes" or "no" to indicate whether the performance met the criteria.

Measure	Desired	Yes	No
7) Left 360^o Steep Turn			
Altitude	$\pm$100 ft	_____	_____
Airspeed	$\pm$10 kts	_____	_____
Bank Angle	$\pm 5^o$	_____	_____
8) Right 360^o Steep Turn			
Altitude	$\pm$100 ft	_____	_____
Airspeed	$\pm$10 kts	_____	_____
Bank Angle	$\pm 5^o$	_____	_____
Meets Practical Test Standards		_____	_____

Instructor______________________ Date___________ Subject Number________ IPC 2

Unusual Attitude Recovery
Please test one unusual attitude recovery immediately after the steep turns. Check “yes” or “no to indicate whether the subject’s performance met the criteria.

Task	Yes	No
Applies in appropriate order, **Bank, Pitch** and **Power** in a timely fashion during recovery.	_____	_____

ILS Approach (DEC ILS 6 Via RV)
Please test the ILS approach last while at Decatur. Check "yes" or "no" to indicate whether the subject’s performance met the criteria.

Task	Yes	No
9) ILS 6 Intercept (RV to the FAC)		
Tune, Ident Localizer	_____	_____
Identifies Proper Course	_____	_____
Altitude $\pm$100	_____	_____
10) ILS 6 Inbound Tracking to FAF		
Less Than Full-Scale CDI Deflection	_____	_____
Altitude $\pm$100 ft (When holding constant altitude)	_____	_____
Heading $\pm 10^{o}$	_____	_____
Starts Time at FAF	_____	_____
Properly Intercepts Glide Slope	_____	_____
11) ILS 6 Final Approach Segment:		
Less Than 3/4 Scale CDI Deflection	_____	_____
Less Than 3/4 Scale Glide Slope Deflection	_____	_____
Airspeed $\pm$10 kts	_____	_____
Properly Identifies MAP	_____	_____
Meets Practical Test Standards	_____	_____

Instructor______________________ Date___________ Subject Number________ IPC 2

Partial Panel VOR Approach via Radar Vectors (Name of Approach ________________)
Please test a partial panel VOR approach during return to CMI. Check "yes" or "no" to indicate whether the subject's performance met the criteria.

Task	Yes	No
12) VOR Approach Intercept		
Tune, Ident VOR	_____	_____
Set Proper Course	_____	_____
Properly intercepts course	_____	_____
Altitude ±100	_____	_____
13) VOR Approach Inbound Tracking to FAF		
Less Than Full-Scale CDI Deflection	_____	_____
Altitude ±100 ft (When holding constant altitude)	_____	_____
Heading ±10^{o}	_____	_____
Identifies FAF	_____	_____
Starts Descent From FAF or as Appropriate	_____	_____
14) VOR Approach Final Approach Segment to MAP		
Less Than 3/4 Scale CDI Deflection	_____	_____
Airspeed ±10 kts	_____	_____
Maintains MDA +100/-0 ft	_____	_____
Properly Identifies MAP	_____	_____
Meets Practical Test Standards	_____	_____

ATC Procedures/ Communications
Please monitor the subject's ATC procedures and communications throughout the flight. Check "yes" or "no to indicate whether the subject's performance met the criteria.

Task	Yes	No
Subject used appropriate ATC procedures and Communications during the flight	_____	_____

Please indicate the Hobbs time logged on this flight ___________

Did you give an IPC signoff (based on current PTS requirements) **YES** **NO** (circle one)

Appendix H

VFR Flight Familiarization Flight

Instructor______________________ Date___________ Subject Number________

Circle the type of device used: ***Aircraft PCATD Frasca 141***

Time flown (either by hour meter or clock) ___________

VFR Flight Familiarization Schedule:

It is reasonable to assume that most of the participants do not have experience flying the equipment that we are using in this experiment. The following schedule of maneuvers is designed to provide some operating experience with the performance profiles of the PCATD, Frasca 141 and the Sundowner aircraft. These flights are carried out prior to the IPC flights. It is recommended that this training be scheduled for **one hour**. Verbal or physical intervention is allowed during the VFR training. All maneuvers during the VFR training are to be performed in VFR conditions without a hood. Check off tasks below as they are completed. All tasks should be introduced during these training sessions. On return to CMI, the subject should fly to about 2 or 3 miles from the airport. At that point, in the Aircraft, the instructor will take over. In the PCATD or Frasca, the flight may be discontinued upon reaching 2 to 3 miles from CMI.

Startup	**Completed:**
Familiarization with cockpit and checklist use	_______

On taxi out:	**Completed:**
Instrument Check during taxi	_______

Maneuvers:	**Completed:**
Takeoff	______
Cruise Climb	______
Level -off	______
Straight & Level	______
Slow flight	______
After reaching practice area:	
180° Std. Rate Turns	______
Steep turns (45 degree bank)	______
A/S and Rate Descent (Precision Profile)	______
A/S and Rate Descent (Non-Prec. Profile)	______
NAV Radio orientation- VOR interception	______
Power-off stall / Power-on stall	______

Appendix I

Flight Experience and Biographical Data Questionnaire

We expect that the pilots involved in this project will have widely varying flight experience. To help us interpret the results of our study, we need to have some background information about your flying experience, and would like you to fill out this questionnaire and return it to us in the pre-paid envelope.

Your answers will help us classify the experience level of the participants in this project. All answers will be confidential. We will code your answers using only an arbitrary reference number assigned to each participant. The data will not be linked to your name in any way.

Please Print Your Responses

Name:_________________________ Date:___________ Ref # ( )

Date of Birth (month, day, year): [ ] Native Language: [ ]
(language you learned to speak first)

Check all Flight Certificates and Ratings you hold:

Certificates/Ratings: (or Military Equivalent)

- ☐ Private Pilot Single Engine Land/Sea
- ☐ Private Pilot Multiengine Land/Sea
- ☐ Instrument Rating
- ☐ Multiengine- Instrument Privileges
- ☐ Commercial Pilot Single Engine Land/Sea
- ☐ Commercial Pilot Multiengine Land/Sea
- ☐ Airline Transport Pilot Single Engine or Multiengine
- ☐ Certified Flight Instructor Single Engine
- ☐ Certified Flight Instructor Instrument
- ☐ Multiengine Flight Instructor
- ☐ Military Flight Instructor (list qualifications below)
- ☐ Helicopter Ratings
- ☐ Other Certificates or ratings:

____
____
____

Please list any Type Ratings you have:

____
____
____

Please fill in the approximate amount of **FIXED WING** aircraft flight time you have:

1) Total Flight Time: ☐

2) Total Simulated Instrument Time (Hood time): ☐

3) Total Actual Instrument Time (IMC conditions): ☐

4) Total Ground Trainer/Simulator Time: ☐
(such as Link, Frasca, ATC, etc.)

5) Total Personal Computer Aviation Training Device (PCATD) Time: ☐
(such as FS-100, 200; Elite PCATDs, etc)

6) Total Dual Instruction Given (if you're a CFI): ☐

7) Total Dual Instruction Received: ☐

8) Total Single Engine Airplane Time: ☐

9) Total Multiengine Airplane Time: ☐

10) Total Night Flight Time: ☐

11) Total Cross Country Time: ☐

12) Total Turbojet Time: ☐

13) Total Turboprop Time: ☐

14) What Type of Aircraft Do You Usually Fly when flying on instruments:
(Check all that apply from each column)

Configuration:	**Engine:**	**Gear:**	**Horsepower:**	**Equipment:**
☐ High Wing	☐ Single	☐ Fixed	☐ Less than 200	☐ Autopilot
☐ Low Wing	☐ Multi	☐ Retractable	☐ 200 or more	☐ Wing Leveler
	☐ Turbine	☐ Tail-Wheel		☐ HSI
	☐ Turboprop	☐ Tricycle- Gear		

15) What year (vintage) aircraft do you usually fly when flying on instruments? ☐

16) Total Recent **FIXED WING** Aircraft Flight Time:

Last 90 days	Last 6 months	Last 12 months

17) Instrument Currency:

To be instrument current, you must have completed 6 instrument approaches and at least one hold in the previous 6 months, either in an aircraft or in a flight training device or simulator.

a) Are you Instrument Current? **Circle one**: YES NO
b) If not, when were you last instrument current? (Date) ____________
c) How many Instrument Approaches have you flown in the last 6 months? _____
d) How many Holding Patterns have you flown in the last 6 months?_____
e) When did you last receive an Instrument Proficiency Check flight to renew your Instrument Currency? (Date) ____________

18) Do you have a current Flight Review (BFR)?
Circle one: YES NO

19) If you have military flight experience, please indicate types of aircraft flown here:

____________________	____________________	____________________
____________________	____________________	____________________
____________________	____________________	____________________
____________________	____________________	____________________

20) What is the main reason that you fly aircraft? Circle one:

a. For Fun
b. Commercially (Airlines, Charter, Corporate)
c. Military
d. Travel Related to my Job
e. Other (please fill in)______________________

21) What type of flying do you normally engage in? Circle one:

a. local (within 50 miles of homebase airport)
b. Cross-Country of 50-200 miles
c. Cross-Country of 201-500 miles
d. Cross-Country of 1000 miles or greater
e. Other (please fill in)_______________________

We are gathering information for a <u>FUTURE project</u> that will potentially require pilots to fly their own aircraft or a rented aircraft. Your answers to the questions that follow <u>DO NOT AFFECT</u> your involvement in the current project. If you do not own your own aircraft or rent, please disregard the rest of this questionnaire.

22) Do you own or rent a single engine aircraft that is instrument equipped and certified for flight in instrument conditions? **YES** **NO** (circle one)

If you answered NO to question 22, please stop here.

23) If you answered **YES** to question 22, would you be willing to fly this aircraft to Willard airport (CMI) for a future project and take an Instrument Proficiency Check (IPC) in that aircraft if partially reimbursed for expenses to travel to CMI? **YES** **NO** (circle one)

If you answered NO to question 23, please stop here.

24) Do you anticipate being willing **<u>and</u>** able to be pilot in command (PIC) during an IPC?
YES **NO** (circle one)

25) If you answered YES to question 23, please answer the following questions about the aircraft you would be willing bring to CMI:

a) What type of aircraft would you bring? ______________________(Full model number and year of aircraft)
b) How much flight time have you logged in this aircraft?______________ (Hours)

c) Does your aircraft have full dual flight controls? (Aileron, Rudder and Elevator controls at both front seats) **YES** **NO** (circle one)

d) Do you, or the place you rent from (in case you bring a rented aircraft) have insurance that covers instruction given by a flight instructor in that aircraft?
YES **NO** (circle one)

26) In order to assure that your aircraft would be appropriate for this project, we would perform an inspection of your aircraft and the maintenance logs at no cost to you. If your aircraft was found to be inadequate for this experiment, you would be notified in writing at the time of inspection as to the reasons why. This report would be kept confidential. In such a case, you would still be allowed to participate in the future project but using the Sundowner (BE-C23) aircraft supplied by the Institute of Aviation).

Would you be willing **<u>and/or</u>** able to present your aircrafts' (or the rented aircrafts') maintenance logs for inspection by an authorized pilot or mechanic at the time of the IPC flight at CMI?
YES **NO** (circle one)

Appendix J

IPC Evaluation Questionnaire: Instructions

- This questionnaire seeks to evaluate the elements in an IPC flight according to their difficulty to observe and record as well as by their criticality to the overall pass/fail judgment made about the student pilot and their sensitivity to differentiate between good and poor pilots.

- In the following pages you will find the standard IPC flight broken down to segments and segment elements (e.g., holding—altitude control). Following each element are three scales, going from 1 to 7 (1-2-3-4-5-6-7).

- The first scale is for the ***difficulty*** of observation and recording of performance on the particular element; please circle one of the numbers on the scale to indicate how difficult IN YOUR OPINION a student pilot's performance on the element in question is to observe and record, 1 representing very easy and 7 very difficult. In the comments section please explain your answer, for example, WHY the observation is difficult.

- The second scale is for the ***criticality*** of the particular element in terms of the overall success of the student pilot. In a similar manner as above, circle a number on the scale to indicate how important good performance in the element IN YOUR OPINION is for the overall outcome of the IPC flight. The endpoints of the scale represent not important (1) and extremely important (7). For example, poor performance in an element receiving a rating of 7 would result in failing the entire IPC flight.

- The last scale is for the ***sensitivity*** of the particular element in bringing out differences in the performance of pilots with different skill level. Circle the number representing how well this element helps YOU to differentiate between good and poor pilots. For example, if even poor pilots regularly score well on altitude control on an outbound leg of a VOR approach, this element should be rated low (1 or 2). On the other hand, if only skilled pilots manage to stay within glideslope deflection tolerances on an ILS approach, it should be rated high (6 or 7).

- Please make use of the fields titled "Any additional comments." Here, feel free to add anything else you may have experienced as a check pilot that would help in assessing the relative difficulties in scoring student pilot performance in the different IPC elements and their criticality to the overall outcome. Feel free also to critique this questionnaire by pointing out questions that you would deem important but that were not asked or any other issues that may be absent from the questionnaire.

Thank you for your cooperation. Your help is greatly appreciated!
Background: Name: ____________________________

- Total flight hours: ____________________________
- Aircraft type ratings: ____________________________
- Certificate level: ____________________________
- Years of experience as a check pilot:____________________
- Number of IPCs given: ____________________________

IPC Element	***Difficulty***	***Criticality***	***Sensitivity***
1. VOR approach via a procedure turn: Course Intercept			
1.1. Tune, Ident VOR	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7
1.2. Set Proper Course	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7
1.3. Properly Intercept course	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7
1.4. Altitude Control	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7

Any additional comments:

2. VOR approach via a procedure turn: Outbound Tracking			
2.1. CDI deflection	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7
2.2. Altitude Control	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7
2.3. Heading Control	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7

Any additional comments:

3. VOR approach via a procedure turn: Procedure Turn			
3.1. Proper Direction Turn	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7
3.2. Altitude Control	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7
3.3. Heading Control	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7
3.4. Proper timing	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7
3.5. Within 10 nm from FAF	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7
3.6. OBS set to inbound	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7
3.7. Correctly intercepts FAC	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7

Any additional comments:

IPC Element	***Difficulty***	***Criticality***	***Sensitivity***
4. VOR approach via a procedure turn: Inbound Tracking to FAF			
4.1. CDI deflection	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7
4.2. Altitude Control	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7
4.3. Heading Control	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7
4.4. Identifies FAF	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7
4.5. Starts Descent at FAF	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7
4.6. Starts time	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7

Any additional comments:

5. VOR approach via a procedure turn: Final Approach Seg. To MDA			
5.1. CDI deflection	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7
5.2. Airspeed Control	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7
5.3. Maintains MDA Altitude	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7
5.4. Identifies MAP	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7

Any additional comments:

6. Holding pattern			
6.1. Tune, Ident VOR	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7
6.2. Set Proper Course	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7
6.3. Recognizes Arrival at Fix	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7
6.4. Prompt Entry	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7
6.5. Proper Entry	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7
6.6. Reports Entry	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7

IPC Element	***Difficulty***	***Criticality***	***Sensitivity***
6.7. Airspeed Control	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7
6.8. Altitude Control	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7
6.9. CDI deflection	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7
6.10. Wind Correction	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7
6.11. Proper timing	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7

Any additional comments:

7. Steep turns

7.1. Altitude Control	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7
7.2. Airspeed Control	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7
7.3. Bank Angle Control	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7

Any additional comments:

8. ILS via radar vectors: Intercept

8.1. Tune, Ident Localizer	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7
8.2. Identifies Proper Course	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7
8.3. Altitude Control	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7

Any additional comments:

IPC Element	***Difficulty***	***Criticality***	***Sensitivity***
9. ILS via radar vectors: Initial segment To FAF			
9.1. CDI deflection	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7
9.2. Altitude Control	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7
9.3. Heading Control	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7
9.4. Starts Time at FAF	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7
9.5. Properly Intercept Glideslope	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7

Any additional comments:

10. ILS via radar vectors: GS intercept to DH			
10.1. CDI deflection	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7
10.2. Glideslope Deflection	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7
10.3. Airspeed Control	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7
10.4. Properly Identifies MAP	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7

Any additional comments:

11. Overall			
11.1. Smoothness on Controls	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7
11.2. Judgement	1-2-3-4-5-6-7	1-2-3-4-5-6-7	1-2-3-4-5-6-7

Any additional comments:

Appendix K

Modification of the IPC Data Logger to Use the FAA Wide Area Augmentation System (WAAS) January 24, 2002

Summary:

The GPS system was originally designed to use RTCM type differential corrections supplied by Differential Corrections, Inc., which were broadcast as sub-carriers on commercial FM stations. This company ceased operations in 2001.

Attempts to use the RTCM signals provided by the United States Coast Guard were unsuccessful in the east-central Illinois area. Altitude errors in excess of thirty meters were unacceptable to the accuracy requirement of the proposed experiments.

Ashtech (now Thales Navigation) has available a “beta” software modification to the Ashtech G12 receivers employed in the Data Logger to allow correction of the positional computation from the Wide Area Augmentation System (WAAS) commissioned by the FAA. The G12 receivers have been modified to use the WAAS information.

Since the WAAS system is still in the testing stages and there is no guarantee that the system will be available on a continuous basis, it was necessary to provide means to verify the adequacy of the WAAS corrections and to use stand-alone GPS when corrections are not available. With the WAAS corrections available, the accuracy is approximately +/- 3 meters horizontally and +/- 5 to 7 meters vertically. This may improve as the WAAS system matures.

This task has been completed in Version 2.xx of the Data Logger Software. With one exception, the interface with the operator is identical to the previous (V 1.xx) software. The exception is that the operator ***can*** begin logging without differential correction being available. Data files recorded with WAAS corrections are uniquely differentiated from previous data files.

Initial Investigations:

After receiving the modified unit from Thales, static tests were performed to determine the accuracy that could be achieved using WAAS corrected data. Initial tests proved favorable and the task of writing software to integrate WAAS corrections into the Data Logger began.

Shortly thereafter, it was noted that at times the corrected positional data appeared to be almost as inaccurate as the uncorrected! Tests run on the Thales software revealed that the software incorrectly flagged WAAS corrections were being effectively applied even if the WAAS signal was not being received, much less if they were adequate to improve the positional solution.

Communications with Thales confirmed this bug in the software. Thales provided additional information as to how to read the raw correctional data from the GPS receiver.

Problem:

The Thales software provided erroneous indications as the application of WAAS corrections and did not allow determining the quality of the WAAS correction data unless the data was being applied to the positional computation.

Furthermore, the Thales software did not provide a means of switching between the WAAS ionospheric correction data and the almanac/ephemeral ionospheric correction model (in the event of loss of the WAAS signal). The failure to apply ionospheric corrections in autonomous GPS positional computations result in unacceptable 30-meter errors in altitude!

Solution:

It was necessary to read much more information each second from the GPS receiver in order to be able to solve this problem.

The software of the Data Logger was modified to increase the communication speed between the logger and the GPS receiver by a factor of four (from 9600 to 38,400 baud). This creates an additional failure mechanism in the system but appears unavoidable.

The number of messages requested from the GPS receiver was increased from two to four. This increased the number of bytes received each second by the logger by a factor of three or more (the message length is now variable, depending on the number of satellites received).

The Data Logger now sends commands to the GPS receiver during actual data logging operations, increasing the load on the communication channel between the devices.

The operational changes are detailed below:

1. Ephemeral ionospheric corrections are enabled at startup.
2. WAAS correction system **without applying corrections** is enabled at startup.
3. If and when the WAAS signal is received and locked, the WAAS corrections are applied to the positional solution.
4. Once a sufficient number of corrections are available from WAAS, the ephemeral ionospheric corrections are disabled, and the positional information **IS** marked as differentially corrected.
5. If the number of WAAB correction fall below the required number, ephemeral ionospheric corrections are re-applied and the positional data is marked as **NOT** differentially corrected.
6. If the WAAS signal is lost, the WAAS corrections are **NOT** applied, ephemeral ionospheric correction are applied, and the positional data is marked as **NOT** differentially corrected.
7. Switching between these modes of operation are automatic and continue throughout the data logging session with appropriate marking of the data and indication to the operator.

Additional:

There are several mode of WAAS operation. “Partial” or “non-Partial” which inhibits a positional solution if all satellites do not have WAAS correct data (if “non-Partial”). It has be determined that this mode should be set to “Partial” since the alternative is a very much reduced availability of WAAS corrections.

Another mode is "precision " or "non-precision", this question was addressed in test flights on Thursday, January 24, 2002. Precision mode seems to be available most of the flight time (however it seems to time-out quickly during violent maneuvers as used in the test flights) and will be used initially as the standard operational mode.[1]

A non-WAAS option concerns the time-constants of the Kalman filters. These parameters were set to maximum dynamics in the original software since there were very fast differential corrections available. Flight tests on Thursday, January 24, 2002 were able to confirm that a restricted dynamics setting did not did change the accuracy of the positional computation.[2] Low dynamics have been implemented as the standard operational mode in the revised software.

Additionally the recorded GPS mode variable has been modified by adding "200" to the standard mode indication. This will make it evident that these data are using WAAS corrections vs. DCI RTCM corrections.

[1] A version of the Data Logger software will be compiled using the non-precision WAAS mode and made available for future installation. If additional flights indicate unacceptable lost of WAAS corrections, this version can be easily installed to correct the situation.

[2] The dynamics were tested by executing ninety-degree turns as quickly as safely possible and examining the positional data for overshoot in the original direction of flight. Tests with maximum dynamics and restricted dynamics exhibited no discernible difference in recorded flight tracks.