Validating a Cognitive Model of Approach based on the ACT-R Architecture

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General Introduction

This phase of the project focused on further developing the model that we presented at the March 2003 workshop along two principal lines. That model consisted of two parts. The first part is an ACT-R model that represents the cognitive, perceptual and motor processing of the people at the control of the aircraft. The second part is an IMPRINT model that represents the state of the aircraft, including its controls and indicators (both conventional and the Synthetic Vision System (SVS)) and the state of the world at large, including communications from the air traffic controllers.

In this phase of the project, we attempted to increase the generality of each model, both as a way of improving their range of applicability and of bringing more constraints to bear on the verification and validation of the models. The most straightforward generalization was the IMPRINT model. We needed to add the other scenarios to the original one to create the full set of conditions encountered in the human data collection.

We then needed to generalize the ACT-R model to handle the new conditions arising in the other scenarios than the one for which it had been defined. This generalization proceeded along two distinct paths, one which extended the model by developing a general method for attending to sources of information based on their learned utility (described in this section), and one which extended the model by incorporating a deeper task analysis based on human performance data collected for this task (described in the validation section).

Generalizing the ACT-R approach model through learned utility of information sources

We needed to handle the choice between the primary instrument panel and the Synthetic Vision System, both of which offer similar information about the world, in a more principled manner. The motivation for a more principled treatment was two-fold. The first goal was to examine more closely the benefits offered by the synthetic vision system. The second goal was to explain some of the data analyses performed in the first phase, especially the result showing that some crews learned to rely almost exclusively on the SVS while other crews mostly stuck with the traditional instrument panel. Both crews primarily focused their attention on either panel while occasionally glancing at the other one.

The first model had been written, its knowledge engineered in the form of production rules and chunks of declarative knowledge, to perform a particular scenario in the default aircraft configuration. We could have extended the same model to the new conditions encountered in the other scenarios. Production system models can usually be generalized quite easily by simply adding more production rules and/or knowledge chunks to handle

new conditions without disrupting their existing functionality.[1] However, this wouldn't have served either of our goals outlined previously: it wouldn't have brought new constraints to bear on the model and its validation, and it wouldn't have explained the dichotomy of reliance on either source of information regarding the world and the aircraft.

Therefore, we decided to generalize the ACT-R model through learning rather than exclusively through knowledge engineering. Learning in cognitive architectures such as ACT-R and Soar provides two principal advantages. First, it brings more constraints to bear on the model because the learning processes contain many fewer degrees of freedom than a knowledge engineering process performed by a human modeler. Second, learning allows the modeling of the fundamental human processes of encountering a new situation and adapting to it. That is certainly what the crews encountered when they were asked to perform their usual tasks in an environment in which a crucial new piece of equipment had been added, specifically the SVS system. More precisely, learning would allow us to explain why some crews came to rely primarily on the new system and why others mostly chose to ignore it. This modeling approach provides the added practical benefit not only of supporting the design of the new system but its real-world adoption as well.

Learning at multiple levels of decomposed tasks

The original ACT-R model had been designed as a two-level goal decomposition process. At the top level was the goal to decide which control to monitor next. This level was implemented as a round-robin loop that tested the previous control and scheduled the next one. At the lower level was the goal to gather needed information, decide the desired state of the control, and if necessary activate the change. Which source to gather the information from (instrument panel or SVS) was also pre-specified.

To enable learning to proceed, the hardwired symbolic constraints at both levels was removed to allow the architectural learning processes to take their place in tuning subsymbolic parameters to perform the decision instead in an adaptive manner. Specifically, the hardwired monitoring loop at the top level was removed to instead allow it to learn which controls to monitor. Each production specifying a different control to monitor can now compete with all others in the conflict resolution process that determines which rule is selected to fire. Similarly, at the lower level two productions rules are created for each goal to gather information about a specific instrument: one production rule will gather than information from the traditional instrument panel while the other will obtain it from the SVS display.

How are the competing productions selected and how is learning reflected in the conflict resolution process? The process of selecting which production to fire at each cycle, known as conflict resolution, is determined by subsymbolic quantities called utility that

[1] At least theoretically. As a practical matter, the new knowledge sometimes interferes with the existing one and can lead to difficult debugging and re-validation cycles.

are associated with each production. The utility, or expected gain, E of a production is defined as:

$$E = P \bullet G - C$$ **Expected Gain Equation**

where G is the value of the goal to which the production applies, and P and C are estimates of the goal's probability of being successfully completed and the expected cost in time until that completion, respectively, after this production fires. Conflict resolution is a stochastic process through the injection of noise in each production's utility, leading to a probability of selecting a production i given by:

$$p(i) = \frac{e^{\frac{E_i}{t}}}{\sum_j e^{\frac{E_j}{t}}}$$ **Conflict Resolution Equation**

where $t = 6/$. A production's probability of success and cost are learned to reflect the past history of use of that production, specifically the past number of times that that production lead to success or failure of the goal to which it applied, and the subsequent cost that resulted, as specified by:

$$P = \frac{Successes}{Successes + Failures}$$ **Probability Learning Equation**

$$C = \frac{\sum Costs}{Successes + Failures}$$ **Cost Learning Equation**

Costs are defined in terms of the time to lead to a resolution of the current goal. Thus the more/less successful a production is in leading to a solution to the goal and the more/less efficient that solution is, the more/less likely that production is to be selected in the future. Those terms, *costs*, *successes* and *failures* will decay over time according to a power law process. Thus a recent experience will initially have more weight in the sums and ratios of the learning equations than an older one, but that weight will gradually decrease as time passes.

The learning process for production utilities at both levels thus depend fundamentally upon the defining of successes and failures at the end of each goal and the accumulations of costs (in terms of time spent) to reach the end of the goal. At the top level, a goal to choose the next control to monitor (and set a subgoal to accomplish that task) is deemed successful if the monitoring resulting in some action being taken. Otherwise, the monitoring of that particular control was deemed in vain and the goal resulted in failure since it wasted time and perhaps the opportunity to monitor some more pressing control. At that level, the learning will accomplish a similar but more flexible version of the initial round-robin selection. When a control task is selected and results in an adjustment, its utility goes up because its estimate of success is also increased. It is then likely to be

selected again shortly because of that high utility, but then will likely result in failure because the underlying situation hasn't changed enough to justify a new adjustment to that control. The utility of that production is then downgraded because of the failure, meaning that it won't be selected again until the failure has decayed and the productions associated with the other tasks have also incurred their own failures, at which point the cycle repeats. This process is quite similar to the hardwired round robin, but considerably more flexible. Since utility is stochastic, conflict resolution is probabilistic, leading to the constant exploration of new combinations. More fundamentally, the learning process will be sensitive through successes and failures to the frequency at which the underlying situation affecting a given control changes. This will result in productions associated with controls that require more frequent adjustments having higher utilities than others, and thus being selected more frequently. However, if that frequency changes over time, the conflict resolution process will again adapt through the time decay of the learning terms and change its frequency of selection to reflect the new situation.

At the lower level, we assume that a goal to capture information about underlying state variables, decide what to do with the given control and (optionally) perform the action is always successful. What varies is the cost in terms of time spent of performing these actions, in particular the capture of information from display panels. Our basic assumption (see section below for elaborations) is that it takes much less time to capture information from the same source (traditional instrument panel or SVS system) once one's visual attention is already there. Therefore given a low-level production that decides (and acts upon) which source to capture information from the cost of that production will primarily reflect where a shift of attention between display panels is required, or whether a much more minor and faster shift of attention between displays on the same panel is all that is needed. Note that that information is not represented symbolically at the production level, i.e. productions to capture information simply specify a source, and not whether it involves switching between panels or not. It is simply used to learn the productions utilities. What results is a gradual convergence to either display panel. Initially, productions have similar utilities and given their stochastic selection the model will cull information from either display with equal likelihood. But as one source starts being preferred through sheer randomness, the utilities for productions associated with that source will decrease while those associated with the other source will increase, leading to a winner-take-all process that will result in the model preferring one source over the other consistently, except for occasional glances to the other driven by conflict resolution stochasticity. This pattern reproduces the analysis of human data that we set out to emulate at the outset, not from our engineering the result into the model, but instead by turning on the architectural learning mechanisms, driven by environmental constraints.

One rather remarkable fact of this learning process is that while it takes the form of a single mechanism operating uniformly across two goal levels, it results in fundamentally opposite patterns at each level. At the top level, a round robin selection process emerges that makes sure all controls are attended to at some regular intervals. At the bottom level, a winner-take-all process emerges that gradually chooses to rely upon either of the two

main sources of information at the almost complete exclusion of the other. However, to achieve these two very different outcomes from the same process, we had to make one minor change to the ACT-R architecture. We partially reversed a change from ACT-R 4.0 to ACT-R 5.0 and made the utility learning process a goal-specific process again rather than a global process. This change was necessary to prevent catastrophic interference between the learning at the two levels. For instance, a lengthier search for information at the lower level should penalize the selection of a control that needed to be updated. That architectural change is still compatible with the ACT-R 5.0 architecture but indicates that some of the power of the ACT-R 4.0 mechanism was indeed essential.

Further investigations suggested by learned utility of information sources

In this model we have assumed that extracting information from the SVS system was a process neither more nor less efficient than from the conventional instrument panel. If an assumption was made based upon finer distinctions of the cost of harvesting information from the respective displays that one panel was more efficient than the others, this model would make predictions about the probability of adoption of the more efficient display over the other. Nothing in the model would need to be changed other than the costs of the various perceptual operations in each display. As new technologies emerge, their efficiency and rate of adoption could be easily studied by simply representing their costs rather than their entire operation.

Another process that can be studied in detail is the speed at which trained pilots adapt from one category of display to another. The process is basically one of overcoming well-trained productions with new ones with presumably higher utilities. The speed at which the skill at using the new displays will lead to the replacement of the skills associated with the established ones can also be studied under various assumptions of efficiency and errors. This can lead to the design of training procedures designed to maximize speed of adoption and reduce errors associated with the training phase during which skills conflict and might result in incorrect decisions and actions.

IMPRINT Simulation Description

For the NASA human performance modeling project, an IMPRINT task network model was created to simulate an aircraft landing on a runway. At a broad level, the purpose of the IMPRINT model is to mimic the simulation that real pilots used during this project with sufficient fidelity to expose the cognitive issues that arise from pilot/plane interface interactions. Thus, the IMPRINT model simulates the external environment (the outside world, atmosphere, landing field, etc.) and the cockpit controls through abstractions that allow a cognitive model to access the information a pilot would have access to in a simulator.

The IMPRINT model is a representation of an aircraft's controls, displays and the environment the aircraft operates in. The IMPRINT model is designed to communicate with the Act-R cognitive modeling software. When these two models execute in parallel, Act-R will model the pilot inside the aircraft. The IMPRINT task network model is constructed of a series of subnetworks representing the different areas of the simulation (see Figure 1). When the simulation is started, the model begins execution in the Start\End Landing network (2). In this subnetwork, IMPRINT connects to Act-R (via LIA) and the Act-R model is initialized. This initialization includes communicating to Act-R the current state of the aircraft and its environment. After the Start\End Landing subnetwork has completed, the following subnetworks begin execution: the Act-R Thought subnetwork (6), the Aircraft Environment subnetwork (1) and the Communication subnetwork (5). The Aircraft Displays subnetwork (3) and the Aircraft Controls subnetwork (4) are executed based upon what control or display Act-R utilizes (this information is communicated between IMPRINT and Act-R).

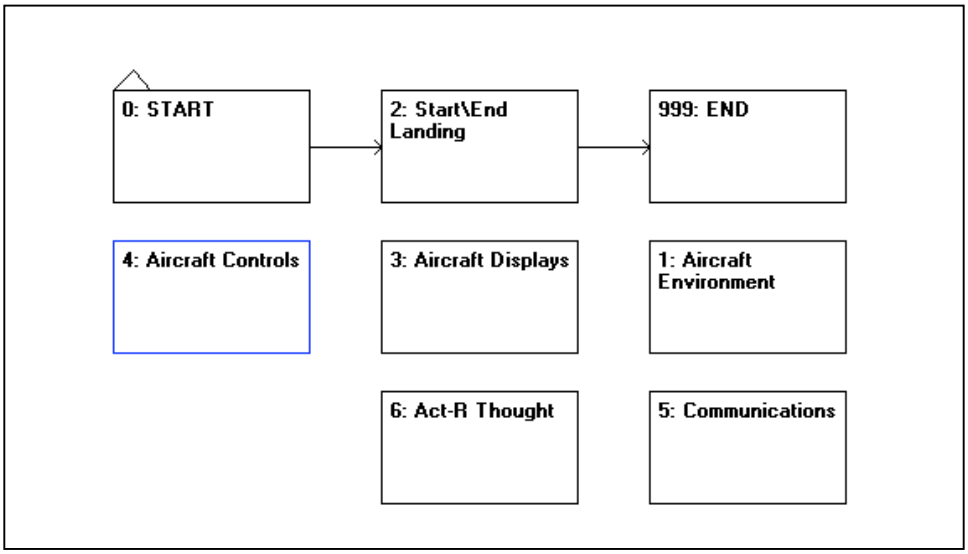


Figure 1: Main IMPRINT Network

When the Communications subnetwork begins, IMPRINT will schedule random communication tasks between the pilot (modeled by Act-R) and general air traffic chatter

(modeled by IMPRINT). Along with these random communication events, regularly scheduled communication between the pilot and air traffic control (ATC) will occur.

The Aircraft Environment subnetwork reflects a basic implementation of the physics of the aircraft and the external environment. The aircraft physics modeled include the aircraft's location in time and space, the aircraft's airspeed and altitude, and all of the aircraft's displays and controls. As the simulation executes, the pilot will set the various controls of the aircraft. These changes will affect the aircraft and are updated in this subnetwork. For example, if the pilot reduces the airspeed, the airspeed will slowly decreases to its new setting and the time it takes for the aircraft to travel to a certain waypoint will increase. As an aircraft's location changes, the external environment is updated. This includes what is visible to the pilot out the window and the distance the aircraft is from the runway. It is the environmental updates that dictate what decisions the pilot will make when landing the aircraft. Both the aircraft and its external environment update every tenth of a second.

The Aircraft Controls subnetwork and the Aircraft Displays subnetwork represent the various controls and displays of the aircraft respectively. In the Aircraft Displays subnetwork (Figure 2), the displays are broken down into the primary flight display, the navigational display, and the out the window display. It is important to note that while there is no true aircraft display for out the window, the pilot has the ability to look out the window to see if the ground is in sight or what the current flap settings are. Inside each Aircraft Displays subnetwork (Figure 2), individual displays are represented by tasks in the IMPRINT model (Figure 3). The Aircraft Controls subnetwork is constructed in a similar manner (Figure 4 and Figure 5). The tasks representing the controls and displays (Figure 3 and Figure 5) are executed when information on a control or display is requested. For example, if Act-R requests from IMPRINT the value of the Altitude Indicator display, IMPRINT will execute the Altitude Indicator task (see Figure 3). When the Altitude Indicator task is executed, the current Altitude (Above Ground Level) of the aircraft is retrieved and communicated to Act-R. This approach is used any time Act-R requires the value of a display or wants to change the setting of a control. This approach also allows IMPRINT to accept any new technologies that are in development and need to be tested.

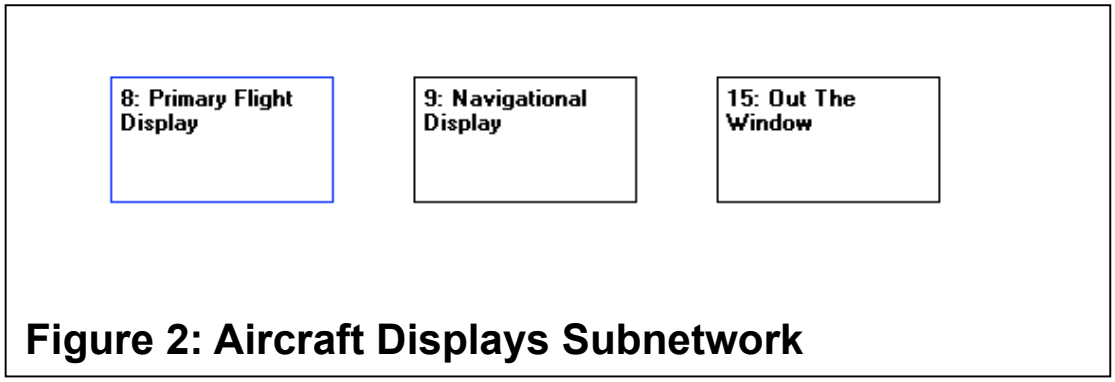
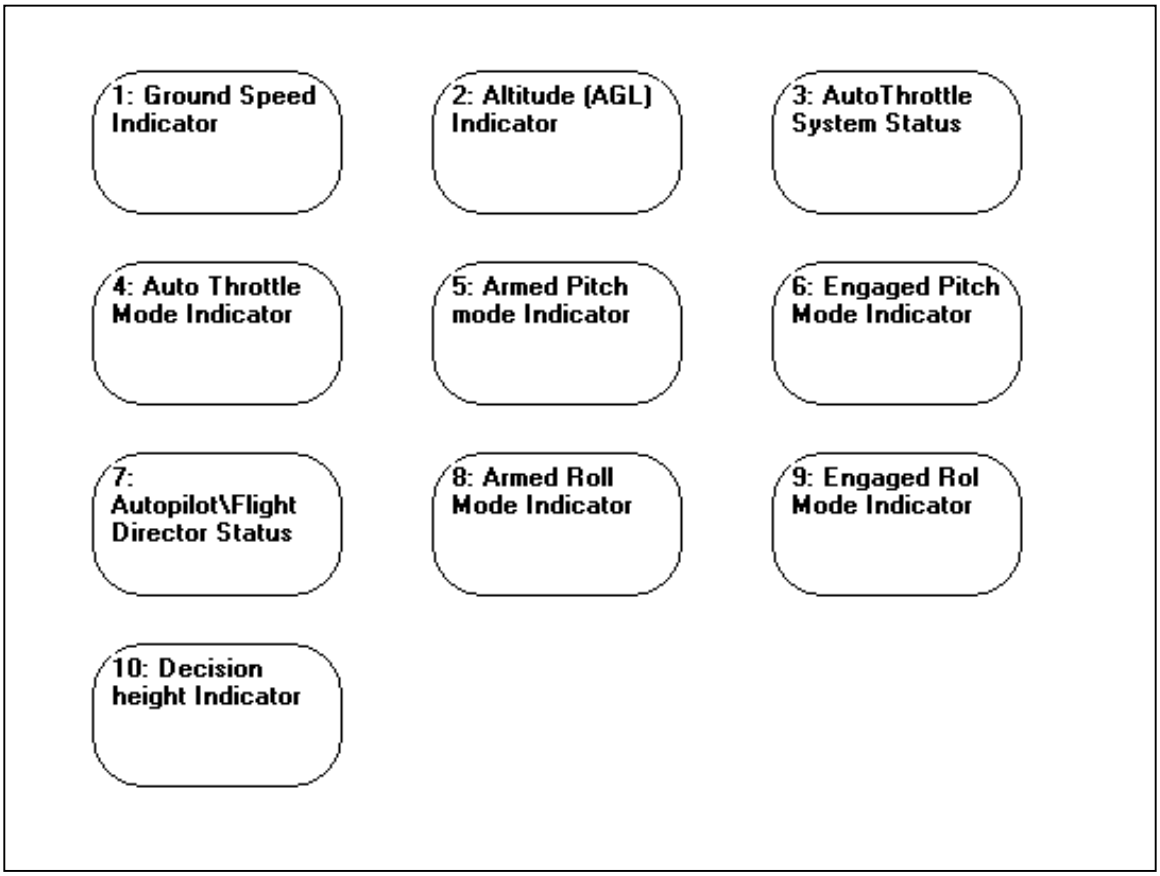


Figure 2: Aircraft Displays Subnetwork



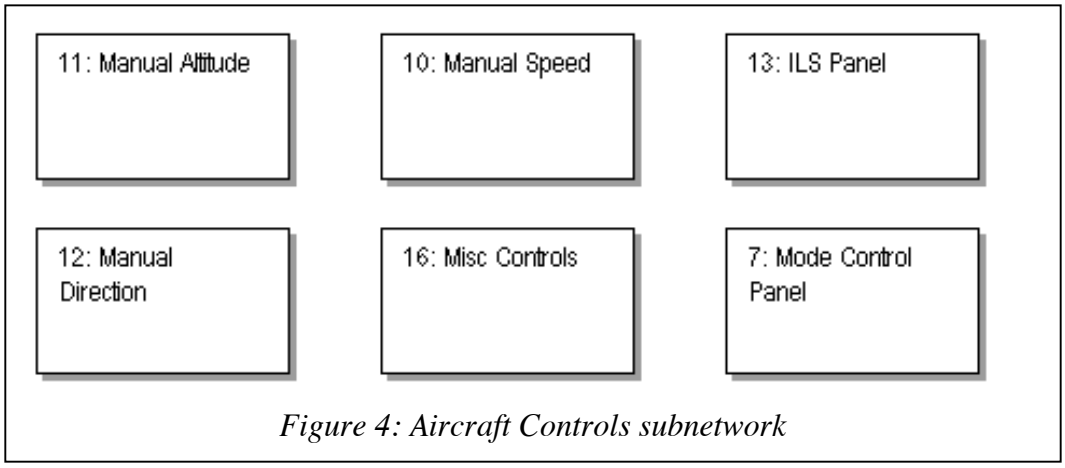


Figure 4: Aircraft Controls subnetwork

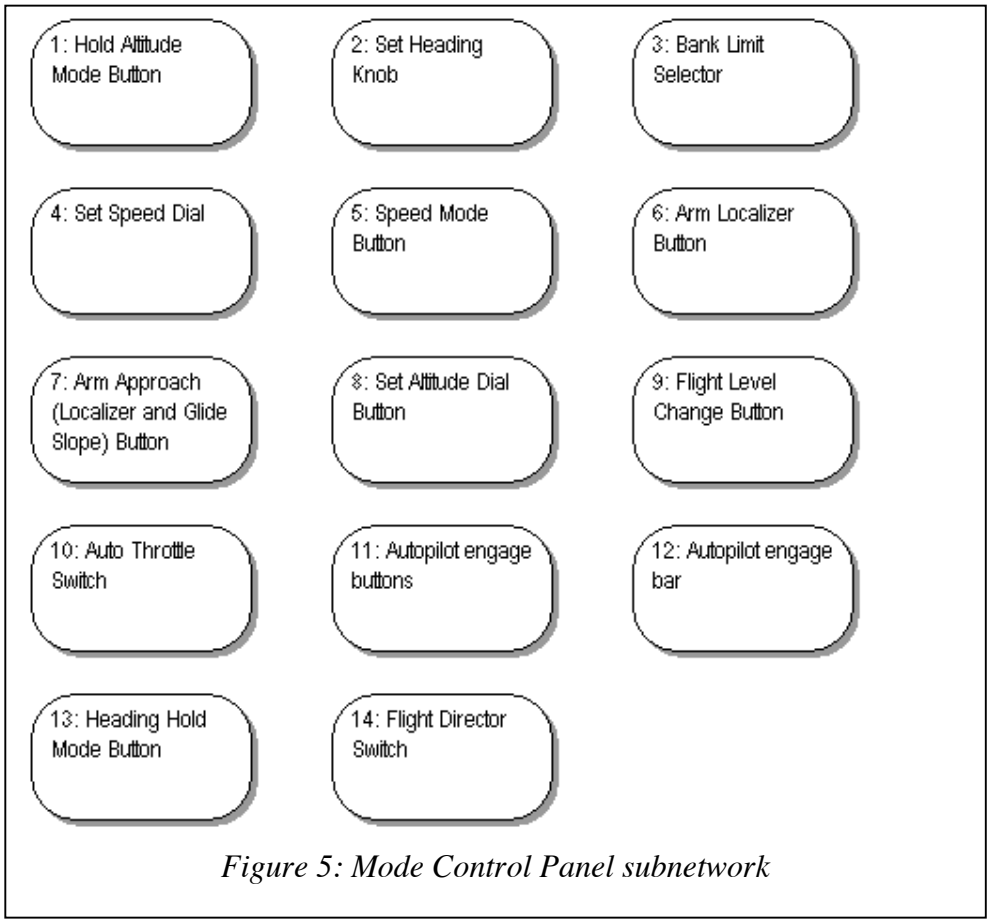


Figure 5: Mode Control Panel subnetwork

The main information transfer between Act-R and IMPRINT takes place inside the Act-R Thought subnetwork. During simulation execution, Act-R will request from IMPRINT what display value it needs or what control to use. IMPRINT will execute the task associated with the appropriate control or display and either return the display's current value to Act-R or set the specified control. As the simulation executes, Act-R will continually updates its memory and control the aircraft until the scenario ends. The scenario ends with either the aircraft landing or Act-R deciding the aircraft needs to go around and attempt the landing again.

The IMPRINT model is designed to simulate ten different scenarios. These scenarios are VMC vectored approach, VMC late reassignment, VMC missed approach, IMC vectored approach, IMC missed approach, IMC terrain mismatch, SVS vectored approach, SVS late reassignment, SVS missed approach, and SVS terrain mismatch. The following chart describes what is different by scenario:

Scenario	ATC Communications	Visibility
VMC Vectored Approach	Normal	Runway visible - 800 feet AGL
VMC Late Reassignment	Late reassignment request -1000 feet AGL	Runway visible - 800 feet AGL
VMC Missed Approach	Normal	Runway visible - 800 feet AGL (traffic on runway)
IMC Vectored Approach	Normal	Runway visible - 650 feet AGL
IMC Missed Approach	Normal	Runway never visible
IMC Terrain Mismatch	Normal	Runway visible - 650 feet AGL (runway 200' misaligned)
SVS IMC Vectored Approach	Normal	Runway visible - 650 feet AGL
SVS IMC Late Reassignment	Late reassignment request -1000 feet AGL	Runway visible - 650 feet AGL
SVS IMC Missed Approach	Normal	Runway never visible
SVS IMC Terrain Mismatch	Normal	Runway visible - 650 feet AGL (runway 200' misaligned)

Selection of the various scenarios will change the aircraft's environment and which displays are available for the pilot to use. The environmental changes include the altitude where the runway can be seen, the condition of the runway (i.e. misaligned or full of traffic) and what ATC communications take place. If the scenario uses the SVS technology, the SVS display will be available for the pilot to take advantage of. Since the IMPRINT model is packaged as source code, a user is able to run any scenario available and add is also able to add new technologies to the aircraft for future testing. In addition, existing controls can be extended to improve their fidelity, modify their function, or otherwise alter them to better suit the simulation goals.

Model Validation

Model validation is an extremely complicated subject – for a model to be completely validated, it would have to reproduce exactly the performance of the human subjects. Given the variable nature of human performance, this task is nearly impossible unless a task is so constrained as to make the model nearly meaningless. For any task of reasonable complexity, a broad range of human behavior can be expected, and the task of validation is to ensure that the model performance falls within the bounds as determined by the human performance.

The ACT-R theory provides some validation by only supporting processes that have been empirically determined to fall within the realm of human capability. That is, architecturally, ACT-R prohibits many actions that an unconstrained computer program (such as one written in C#) could accomplish. In this sense, there is a level of validity obtained simply by using ACT-R since the operations completed by the model are in principle operations that could be accomplished by a human performer of the task. However, these architectural limitations do not ensure that the operations undertaken by the model are the same operations undertaken by the human performer. Validating an ACT-R model of task performance requires that the constraints imposed by human performance on the task be used to inform the actual operations undertaken by the model to produce a validated model.

Validation of the ACT-R/Imprint model against human performance will be examined here at three distinct levels, from broad to fine grain. The first level involves achieving the criterion of successful task completion (to the extent that human performers succeed). The second level involves finer-grained validation of the individual actions taken by the model to determine if they correspond to the individual actions taken by human performers, and is largely qualitative (i.e., establishing that the model's actions have face validity). The third, and final, level involves examining behavioral data at an extremely fine grain and attempting to establish close quantitative correspondence between data captured from an instrumented model and data captured from human performance.

Validation level 1: Successful task completion

The first level, the most basic level of model validation, is a demonstration that the model can in fact accomplish the task. If the model cannot complete the task and human performers can, there is no need to proceed further along the validation path. Our model is a model of the pilot flying (PF) during runway approach. We have abstracted the pilot not flying (PNF, who is in the case of the experimental data a confederate) since all the PNF does is operate controls and our primary interest is in the cognitive operations of the PF. In the case of this approach model, the model achieves the same outcome as human pilots flying the scenarios in the simulator in each case. These scenarios and the identical outcomes (scenario conclusions) reached by both human pilots and the model are detailed in the table below:

Scenario Number	Description	Outcome
1	Baseline VMC	Disengage autopilot and prepare to land
2	Baseline VMC	Late reassignment (land on parallel runway)
3	Baseline VMC	Terrain mismatch (traffic on runway)
4	Baseline IMC	Nominal landing (land on parallel runway)
5	Baseline IMC	Missed approach (go around)
6	Baseline IMC	Terrain mismatch (go around)
7	SVS IMC	Disengage autopilot and prepare to land
8	SVS IMC	Late reassignment
9	SVS IMC	Missed approach (go around)
10	SVS IMC	Terrain mismatch (go around)

It is not a given that the model would successfully complete the task. The simulation environment requires that the model approach the runway at the proper altitude (through controlling the simulation) and see the runway where it is expected to be. There are several ways things can go wrong. If the simulation results in the plane being above the altitude where the runway can be seen, the result is that the plane would overfly the runway. On the other hand, if decision height is reached prematurely and the runway was not in sight, the model would choose to go around. Correct performance is predicated upon arriving at the decision height at the appropriate distance from the airfield, and therefore critically upon controlling rate of descent, speed of forward motion, and configuration of the airplane to allow a landing to occur. The outcomes above, achieved by both the pilots that participated in the data collection and the ACT-R model, represent the fundamental validation on which more extensive validation depends: the cognitive model successfully completes the task in exact agreement with the human participants.

Validation level 2: Assessing subtask correspondence

Given the first level of validation, we will proceed to the second level of validation, a qualitative assessment of the correspondence between model actions and human performer actions. This aspect of validation can be approached rigorously by encoding the actions taken by the human performer and lining it up with a model trace. This approach is based on the techniques of protocol analysis as described by Ericcson and Simon (1993). In addition, the correspondence between the model's use of the SVS display and actual pilot's use of the display was addressed in earlier development of this model as discussed above, and is incorporated within the version reported here (as well as being briefly addressed below).

Following this approach, the video taped scenarios were transcribed by recording those events that were audible and recording the corresponding time stamp present on the video (the full transcriptions for subject 5 for all tasks are presented in Appendix A). Aggregating these performances and performing a protocol analysis resulted in the emergence of a general task decomposition that was common among the scenarios.

The ACT-R traces require a brief explanation before proceeding. ACT-R actions that execute subtasks within a task are coded as "PROCEDURAL" in the model runs below. The ACT-R model traces also produce actions that are coded as "VISUAL", indicating

looking at something in particular, "MANUAL", indicating a physical action performed, "AURAL", indicating something listened to, and "VOCAL", indicating a speech act. The ACT-R model, because we have access to its inner workings, can thus provide much more fine-grained data on the operations it is performing at any time. This is a general truth of cognitive models, making the validation task more difficult since we only have access to sparser information about the detailed cognitive processes the human participants are involved in (the model must do much more than the human pilot says they are doing just as the human pilot must do much more than they say they are doing to complete the task). An ACT-R trace for each scenario is presented in its entirety in Appendix B.

(Note: Actions of the human pilot are coded similarly in the excerpts below to aid the reader in aligning pilot actions to model actions. The coding adopted in the appendix, and the coding used for the protocol analysis is different from this, though there is a one to one mapping between the two.)

The performance of approach tasks can be broken down into the following main tasks and subtasks (these tasks do not necessarily correspond to other previous categorizations of approach tasks and focus instead on the cognitive phases as demonstrated by human performance in the simulation environment as demonstrated on the videotaped scenario runs):

1. Simulation initiation
    a. Encode and respond to ATC instructions for approach
    b. Set aircraft configuration for approach
        i. Set speed brakes
        ii. Set LNAV/VNAV
        iii. Set autopilots on
        iv. Set flaps to 1 or 4
        v. Check altitude

2. Descent from 3000 feet
    a. Check/Adjust speed
    b. Check/Adjust flaps
    c. Check/Adjust altitude dial
    d. Check/Adjust map scale
    e. Check altitude
    f. Check/Adjust decision altitude
    g. Check distance to next waypoint
    h. Check/Adjust airbrakes

3. Landing Checklist
    a. Set gear down
    b. Set flaps 15
    c. Set speed brakes armed
    d. Set speed 135

e. Notify cabin of landing

4. Final Approach (nearing decision altitude)
    a. Check/Adjust flaps (set full flaps on)
    b. Make landing decision at decision height
        i. Check altitude
        ii. Check runway (out the window)
        iii. Decide to land or go around

The main tasks can be separated into two distinct categories: 1) schematic scripts (simulation initiation, and landing checklist), and 2) reactive monitoring tasks (descent from 3000 feet, and final approach). The tasks above occur in the order presented. The schematic tasks are characterized by rapid performance of the subtasks while the monitoring tasks take up the time between the schematic tasks.

This sequence of tasks is worth examining in further detail. Upon simulation initiation (within 30 seconds of simulation start), regardless of the scenario, the pilot flying (PF) rapidly performs the subtasks listed above under the main task "simulation initiation" in a scripted fashion (the pilot sets LNAV/VNAV, sets autopilots to engaged, sets flaps to setting 1, etc.). This is followed by a period of roughly seven minutes of monitoring the descent, occasionally gradually adjusting controls. At this point the pilot flying calls out the landing checklist, again a scripted set of actions including lowering the landing gear, arming the speed brakes, etc., which ensures that the aircraft is configured for landing (typically read off of a card though sometimes read from memory). The landing checklist only takes on the order of ten seconds to complete. This is followed by a period of roughly three minutes while the final approach is monitored, during which flaps are set to their final setting, and the pilot monitors their altitude relative to the decision altitude while looking for the runway out the window. These tasks form the macro-structure of all scenario performances, and are therefore shared by all of the individual task models (in fact, one ACT-R model performs all of the scenarios; this model is not parameterized for any scenario and is not provided with the current scenario beyond the presence/absence of the SVS). These tasks also directly form the macro-structure of the ACT-R model itself, which is both an aid in development and validation (the model maps directly onto the cognitive constructs; it is presented in Appendix C).

The performance of actions during these phases (for the baseline IMC non-SVS condition) is demonstrated by protocol excerpts from several scenarios for Subject #5, Tape 1 (Baseline-IMC-normal landing) and the corresponding model trace. Excerpts were selected from scenario runs that provided the most detailed information for validation (the situations described had corresponding episodes in each of the scenario runs; the most complete verbal/visual protocols available were used).

Validating Task 1 – Simulation Initiation:

The human performance protocol during this phase is as follows:

```
OPERATOR-TYPE    TIME       OPERANDS
PROCEDURAL       40:03      Preparing for approach: setting LNAV
PROCEDURAL       40:04      Preparing for approach: Speedbrakes Full
PROCEDURAL       40:05      Autopilots engaged
PROCEDURAL       40:06      Preparing for approach: Set Flaps 1
```

This section involves setting the flaps, autopilot, LNAV and VNAV just after simulation initiation (from 2.4 seconds into the simulation to 8.9 seconds into the simulation).

```
PROCEDURAL    2.363 Preparing for approach: setting Flaps 1
MANUAL    2.363 flaps set 1
PROCEDURAL    3.435 Preparing for approach: setting VNAV
VISUAL    3.435 waypoint Value 1
PROCEDURAL    6.476 Preparing for approach: engaging Speed-brakes full
MANUAL    6.476 airbrakes on/off 0
PROCEDURAL    7.649 Preparing for approach: setting LNAV
VISUAL    7.649 distance-next Value 1
PROCEDURAL    8.899 Preparing for approach: engaging Autopilot
VISUAL    8.899 autopilots Value up
```

Note that the actions do not occur in the same order. This is typical of human performance during simulation initiation, where the same set of actions occur, but the order is not specified. The model produces the same stochastic effect where different runs will produce a different ordering of the subtasks involved in initiating the simulation. Also note that this particular process does not have an explicit checklist (like landing does), and the pilot has NOT in this case ensured that the VNAV was set (though this pilot explicitly does so in almost every other scenario). In contrast, our model is using an explicit checklist at this point and does not miss the item.

Validating Task 2 – Descent from 3000 Feet:

The human protocol during the descent from 3000 feet is somewhat sparser than the model protocol (the model reports everything it is looking at while the pilot reports only changes to controls being made). The following explicit actions take place (though there is also constant monitoring of various controls and displays as evidenced by the eye-tracking data):

```
OPERATOR-TYPE    TIME   OPERANDS
PROCEDURAL       43:40 retract Speedbrakes
MANUAL           43:42 set Speedbrakes retracted
PROCEDURAL       46:30 lower gear
MANUAL           46:31 set gear down
PROCEDURAL       46:32 Flaps 25
MANUAL           46:33 set flaps 25
```

The following segment is a section of the trace that illustrates actions during the descent from 3000 feet (only a portion is included here; for a full trace, see the appendix). This segment of the trace involves monitoring the status of various systems. The pilot first checks the status of the autopilot and looks out the window at 47 seconds. The pilot then checks the status of the speed brakes at 51 seconds and, now that the plane speed has

decreased, chooses to disengage them. The pilot then checks that the decision altitude is set at 54 seconds (which it already is). At 57 seconds, the pilot checks the value of the speed dial, which is 160 knots, and decreases it to 140 knots. The pilot then looks at the altitude and notes that the current altitude is 2500 feet. This is followed by lowering the landing gear at 65 seconds, and adjusting the flaps from 15 to 25 at 69 seconds.

```
PROCEDURAL   47.436 SubGoal checking Autopilot
VISUAL   48.498 otw_runway Value out-of-sight
VISUAL   49.650 autopilots Value up
VISUAL   50.626 altitude Value 2500
**Goal37    8.341
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 2500
   decision EngagedGOAL37 DIAL DIAL T Ignore-Autopilot
PROCEDURAL   51.327 SubGoal checking Speed Brakes
VISUAL   52.596 speed Value 170
VISUAL   53.478 airbrakes Value off
**Goal41    8.261
   isa SPEED-BRAKES
   speed 170
   decision OffGOAL41 DIAL DIAL T Decide-Speed-Brakes
PROCEDURAL   54.078 SubGoal checking Decision Altitude
VISUAL   55.277 waypoint Value 2
VISUAL   56.261 distance-next Value 2
RETRIEVAL   56.361 Waypoint 2 Next 2 Distance 13
**Goal44    5.025
   isa SET-DECISION-ALTITUDE
   waypoint 2
   distance-next 2
   distance 13
   old 600
   decision 600GOAL44 DIAL DIAL T Ignore-Decision-Altitude
PROCEDURAL   57.017 SubGoal checking Speed
VISUAL   57.906 waypoint Value 2
VISUAL   58.834 distance-next Value 1
RETRIEVAL   58.934 Waypoint 2 Next 1 Distance 12
RETRIEVAL   59.034 Speed
VISUAL   60.278 dial-speed Value 160
MANUAL   63.031 dial-speed set 140
**Goal47    5.210
   isa SET-SPEED
   waypoint 2
   distance-next 1
   distance 12
   speed 140GOAL47 DIAL DIAL T Dial-Speed
PROCEDURAL   63.641 SubGoal checking Altitude
VISUAL   64.715 altitude Value 2500
**Goal52    4.935
   isa CHECK-ALTITUDE
   altitude 2500
   previous 2500GOAL52 DIAL DIAL T Ignore-Altitude
PROCEDURAL   65.372 SubGoal checking Landing Gear
VISUAL   66.437 waypoint Value 2
VISUAL   67.335 distance-next Value 1
```

```
RETRIEVAL   67.436 Waypoint 2 Next 1 Distance 12
VISUAL   68.252 landing-gear Value down
**Goal54    8.342
   isa MOVE-GEAR
   waypoint 2
   distance-next 1
   distance 12
   decision DownGOAL54 DIAL DIAL T Decide-Gear
PROCEDURAL   68.852 SubGoal checking Flaps
VISUAL   69.918 speed Value 159
RETRIEVAL   70.068 Flaps 25
VISUAL   71.025 flaps Value 15
MANUAL   73.940 flaps set 25
**Goal58    5.046
   isa SET-FLAP
   speed 159
   flap 25GOAL58 DIAL DIAL T Set-Flaps
```

Again, the trace indicates many of the same actions are completed, though the order is not specified. This captures the variability of the human data as well, where this segment of flight is characterized by monitoring of various systems. Much of the trace from this segment (a complete listing is presented in the appendix) shows the pilot alternately checking controls that already have the desired value. The segment selected above shows a period of transition where several control values actually are altered, as they are in the human protocol.

Validating Task 3 – Landing Checklist:

The landing checklist is completed by notifying the cabin to prepare for landing, lowering the landing gear, setting the speed to 135 knots, arming the speed brakes, and setting the flaps to their final setting (40). These actions take approximately ten seconds to complete for pilots and roughly the same for the model (from 140 seconds to 153 seconds in this case). In this case, the excerpted human protocol (subject 5, scenario #9, SVS, IMC, missed approach) and the model protocol are extremely similar (exactly as we would expect for the more highly scripted sections of performance).

Once the pilot in the simulator announces it is time to perform the landing checklist, in rapid succession (8 seconds in this case) the pilot and copilot check that the gear are down, set the flaps to 15, arm the speed brakes for automatic deployment on landing, and set the speed dial to 135 knots.

```
OPERATOR-TYPE    TIME    OPERANDS
PROCEDURAL       3:05:02 landing checklist
PROCEDURAL       3:05:03 gear down
VISUAL           3:05:04 gear Value down
PROCEDURAL       3:05:05 flaps 15
MANUAL           3:05:06 set flaps 15
PROCEDURAL       3:05:07 speed brakes armed
MANUAL           3:05:08 set speed brakes armed
PROCEDURAL       3:05:09 speed 135
MANUAL           3:05:10 set speed 135
```

Similarly, upon deciding to execute the landing checklist, the ACT-R model quickly announces to the cabin to prepare for landing (this step was skipped by the pilot in the simulator in this run but was included by this pilot in other runs), checks that the gear are down, sets the speed to 135, sets the speed brakes to armed, and sets the flaps to 15.

```
PROCEDURAL  139.975 SubGoal completing landing checklist
PROCEDURAL  142.313 Landing checklist: preparing cabin for approach
VOCAL  142.313 nothing communication 2007
PROCEDURAL  145.058 Landing checklist: setting Gear down 1
MANUAL  145.058 landing-gear up/down 0
PROCEDURAL  147.611 Landing checklist: setting Speed to 135
MANUAL  147.611 speed set 135
VISUAL  147.611 speed Value 142
PROCEDURAL  151.038 Landing checklist: setting Speed-brakes to armed
MANUAL  151.038 airbrakes on/off 0
PROCEDURAL  153.097 Landing checklist: setting Flaps 15
MANUAL  153.097 flaps set 15
VOCAL  153.147 Landing Checklist Complete
```

Validating Task 4 – Final Approach:

The final approach is relatively simple, though critical. As this task is initiated, flaps are set to the final setting (40) and the pilot enters a cycle of monitoring the altitude relative to the decision altitude, and looking for the runway. If a clear runway is visually identified by the decision point, the pilot decides to land. Otherwise, the pilot calls a missed approach and goes around. The following sequence (from subject 5, Baseline IMC missed approach) shows the operations performed by the pilot just prior to landing:

```
OPERATOR-TYPE    TIME    OPERANDS
PROCEDURAL       1:33:24 full flaps
MANUAL           1:33:25 set flaps 40
PROCEDURAL       1:35:16 check altitude
VISUAL           1:35:17 altitude value 1000
PROCEDURAL       1:35:37 check altitude
VISUAL           1:35:38 altitude value 650 -- approaching decision
PROCEDURAL       1:35:42 check altitude
VISUAL           1:35:43 altitude value 600 -- decision height
PROCEDURAL       1:35:44 check out the window
VISUAL           1:35:45 field not in sight
PROCEDURAL       1:35:47 missed approach - go around
```

Similarly, the ACT-R model supports the range of cues and decisions available to a pilot. In this case, for the vectored approach scenario, the ACT-R model checks the altitude and decides to land based on a visible, clear, aligned runway:

```
PROCEDURAL  287.970 SubGoal checking Altitude
VISUAL  288.797 altitude Value 623
**Goal278    4.872
   isa CHECK-ALTITUDE
   altitude 623
   previous 713GOAL278 DIAL DIAL T Ignore-Altitude
```

```
PROCEDURAL  289.455 SubGoal checking Autopilot
VISUAL  290.566 otw_runway Value in-sight
VISUAL  291.751 autopilots Value up
PROCEDURAL  291.801 Disengage Autopilot and land
MANUAL  294.559 autopilots up/down 0
**Goal280   10.012
   isa SET-AUTOPILOT
   visibility In-Sight
   peek nil
   decision DisengagedGOAL280 DIAL DIAL T Disengage-Autopilot
```

Several possible actions are possible at the conclusion of the final approach. These actions as taken by the model and by the human pilots are presented above in the section on Task 1. Only the outcome is different for both different model runs and different pilot runs in the simulator, and these outcomes are in perfect 1:1 correspondence.

Validation of learning the utility of sources of information

The previous modeling effort on this project focused on the learning aspects of progress monitoring during the descent from 3000 feet and the final approach by guiding where to look for information based on the learned utility of looking during online task performance. A result of using this utility model that has previously been demonstrated, and a result that is confirmed in the human data, is that the model will adapt to either use the synthetic vision system or rely on the out-the-window view, but will prefer not to alternate between the views. The current extension of the previous model incorporates these utility learning mechanisms with the standard schematic behavior of quickly performing both the simulation initiation and the landing checklist.

This learning model provides a principled description of monitoring activity that occurs in the absence of a strongly schematic approach to task completion. This task, in particular, is extremely interesting because it depends on both highly-scripted task performance, and on loose and adaptive reactive monitoring between the scripted episodes. The model presented here provides a model of this task, and also a model of how reactive and highly goal-directed behaviors can co-exist within the same architecture.

Validation level 3: Quantitative correspondence of behavioral data with model performance

The third level of validation, a quantitative assessment of correspondence between behavioral data exhibited by human task performance and data produced by the model, depends on a rich body of data on both sides to align. For this project, eye-tracking data was provided for the simulator runs. To establish correspondence with ACT-R model performance, the ACT-R model was instrumented to record the amount of time spent in various subtasks, with the assumption that the task performer would look at what they were doing. We do, however, expect one systematic variation of the model from the human data: since the PNF operates controls during the human performance but the ACT-R model operates these directly during model runs, the ACT-R model should spend

a correspondingly larger amount of time viewing the controls, and therefore, slightly less time viewing other areas of interest.

Quantitative assessment typically depends on having a large enough sample of subject data that any findings can be truly expected to generalize. In the case of this project, we have data for only three pilots completing the task, all running only one trial per scenario. Given these limitations of the data, we have decided to use this as an opportunity to explore data validation methods. However, any findings in this section will be subject to the caveat that the data set used is very limited, and the findings are therefore suggestive. Initially, we will focus on comparison to subject 5, as pursued above, while we will then conclude with comparison to the aggregate data from subjects 3, 4, and 5. The following scenarios were simulated:

Scenario Number	Scenario Description
1	VMC vectored (baseline)
2	VMC late reassignment
3	VMC missed approach
4	IMC vectored (baseline)
5	IMC missed approach
6	IMC terrain mismatch
7	SVS vectored (baseline)
8	SVS late reassignment
9	SVS missed approach
10	SVS terrain mismatch

The experimental data included eye fixation data for the pilots as they performed the tasks. Much of this data was at too fine a level of detail for incorporation into the models we developed here. However, the individual pilot task data also included summary tables of eye dwells in various visual areas of interest, where the tables included both mean dwell time and the total number of dwells for each particular area. This allows the derivation of an exact percentage of fixation time for each area of interest during task performance. For subject 5, across all scenarios, summarizing in this way results in the following table:

Subject 5 Dwell Time in Area of Interest as Percentage of Total Time							
Scenario	MCP	NAV	PFD	SVS	CONTROLS	OTW	off
1	0.04	0.36	0.40	0.00	0.02	0.09	0.05
2	0.02	0.49	0.28	0.00	0.05	0.09	0.04
3	0.04	0.41	0.30	0.00	0.00	0.10	0.13
4	0.00	0.49	0.35	0.00	0.05	0.03	0.05
5	0.03	0.47	0.40	0.00	0.07	0.01	0.01
6	0.06	0.45	0.40	0.00	0.03	0.02	0.04
7	0.03	0.30	0.35	0.20	0.05	0.04	0.02
8	0.03	0.36	0.29	0.23	0.04	0.02	0.02
9	0.05	0.34	0.31	0.23	0.04	0.00	0.02

10	0.01	0.28	0.37	0.25	0.02	0.00	0.06
Avg	0.03	0.40	0.35	0.09	0.04	0.04	0.04

There are several points worth mentioning in this table. First, the pilot spends the majority of his time looking at the navigational display (NAV) and the primary flight display (PFD). The pilot spends an extremely small amount of the total time actually looking at the controls (CONTROLS) area of interest. The primary explanation for this is that, as part of this experiment, a confederate of the experiment played the role of the pilot-not-flying (PNF) and performed most of the control manipulations. The pilot requested that the PNF set the values, but had little need to look at the controls themselves. The synthetic vision system (SVS) was depended on by this pilot a fair amount when available (22% of all dwell time when available). In the VMC conditions (scenarios 1-3), the pilot also spent 9% of the time looking out the window. During IMC conditions, however, the pilot relied primarily on the navigational display (NAV) and the primary flight display (PFD), though he still sampled from the out the window (OTW) view occasionally (2% of total gaze time). However, the low percentage of time the pilot sampled OTW during IMC conditions suggests that peripheral vision played a large role in determining whether or not to look there.

A priori, we expected the ACT-R model of the task discussed here to depart from these values systematically in several ways. First, we chose not to model the whole simulated run, which included substantial amounts of time where nothing was happening, but instead focused on the second half of the approach period, especially final approach, resulting in runs of approximately 280 seconds (vs. approximately 600 seconds for the pilot runs). This means the ACT-R model should spend more time looking out the window relative to the total (i.e., the OTW display is most useful during this phase, so the OTW numbers for the ACT-R model should be inflated relative to subject 5). Further, lacking peripheral vision, the ACT-R model cannot know there is nothing to see out the window unless it actually looks there. That is, the ACT-R model does not represent the well-known covert shifts of attention that allow a person to attend to an area without shifting gaze (and the results from the IMC conditions above indicate strongly that this is occurring). Second, since the ACT-R model does not have a copilot, it actually looks at the controls as it sets them. Thus the ACT-R model should have a higher percentage of dwell time associated with the controls. The dwell percentages as predicted by the ACT-R model are presented below:

Model Dwell Time in Area of Interest as Percentage of Total Time							
Scenario	MCP	NAV	PFD	SVS	CONTROLS	OTW	Off
1	0.08	0.40	0.30	0.00	0.07	0.08	0.07
2	0.07	0.43	0.29	0.00	0.06	0.07	0.07
3	0.11	0.36	0.30	0.00	0.06	0.07	0.11
4	0.10	0.38	0.30	0.00	0.06	0.07	0.10
5	0.10	0.38	0.29	0.00	0.06	0.06	0.11
6	0.10	0.37	0.30	0.00	0.07	0.08	0.08
7	0.11	0.33	0.29	0.06	0.06	0.07	0.09
8	0.10	0.30	0.29	0.10	0.06	0.07	0.08

9	0.10	0.26	0.30	0.12	0.06	0.07	0.09
10	0.11	0.27	0.27	0.09	0.10	0.11	0.04
Avg	0.10	0.35	0.29	0.04	0.07	0.07	0.08

The overall correlation between the model predictions for dwell times and the performance of subject 5 is r=0.93, which means that the model accounts for the overwhelming majority of variance in dwell time (R^2=0.86). Similar individual analyses were conducted for subjects 3 and 4, yielding correlations of r=0.83 and r=0.90, accounting for the majority of variance in these cases as well (R^2=0.69 and R^2=0.82 respectively). The decreased level of fit for subject 3 was partially due to inconsistent behavior: in scenario 6 he allocated 26% of his gazes outside of the established regions of interest, and shifted his reliance on the SVS between 37% and 14% for scenarios 8 and 9. Subject 4 also varied in his reliance on SVS when it was available, allocating between 10% and 30% of his dwell time to the SVS. This variation appears to be exploratory – two of the pilots experimented with different amounts of SVS uses (the data for subjects 3 and 4 are omitted here for brevity but are presented in Appendix D).

Given that there were no discernible strategy differences among the pilots, it also makes sense to collapse the data and compare the model predictions against the aggregate subject performance. The table below presents the averaged dwell percentages of subjects 1, 2, and 3:

All Subjects Dwell Time in Area of Interest as Percentage of Total Time							
Scenario	MCP	NAV	PFD	SVS	CONTROLS	OTW	Off
1	0.03	0.38	0.41	0.00	0.04	0.09	0.03
2	0.03	0.38	0.39	0.00	0.07	0.07	0.03
3	0.03	0.37	0.40	0.00	0.04	0.08	0.06
4	0.04	0.37	0.43	0.00	0.07	0.04	0.04
5	0.04	0.40	0.46	0.00	0.07	0.02	0.02
6	0.04	0.42	0.32	0.03	0.04	0.04	0.11
7	0.05	0.29	0.32	0.20	0.06	0.04	0.04
8	0.04	0.30	0.31	0.25	0.05	0.03	0.03
9	0.04	0.31	0.35	0.22	0.05	0.01	0.02
10	0.02	0.28	0.40	0.18	0.04	0.02	0.05
Avg	0.04	0.35	0.38	0.09	0.05	0.05	0.04

The overall fit of the ACT-R model to the aggregate subject data is r=0.92 (R^2=0.85). As predicted as a result of not modeling the pilot-not-flying (PNF), the ACT-R approach model spends more time focusing on the controls. Also as predicted, because the ACT-R model does not account for peripheral vision, the model must spend more time checking out the window (OTW) than the human pilots to see if something has changed.

The ACT-R model also spends less time using the information on the SVS than the human pilots. This may be due to a bias introduced in the experiment simply through the presence of the SVS: the human pilots were confronted with a familiar cockpit with an unfamiliar device (the SVS) and may have responded to the demand characteristics of the experiment by focusing on the SVS more than it was useful. The ACT-R model

considers the SVS from a purely information-theoretic perspective, and seeks to find information without incurring costs. It is straightforwardly possible to add a bias such as this, but the model is in many ways more interesting as it stands, since the dwell times are more purely a function of seeking information in the environment to perform necessary tasks.

To restate the point, the scan pattern as used by the model *emerges* from the need to complete tasks. It is nowhere represented explicitly in the model, and the model is not parameterized in any way to follow a particular scan pattern. Rather, the model uses a task decomposition to drive its activities, and as those activities require looking for information in certain locations, a scan pattern is produced through the completion of those tasks.

Discussion

The modeling approach chosen here, that of separately modeling the cognitive agent and the simulation environment, has promise for producing validated models that can generalize to other domains and tasks. This is a result of keeping the model free of many of the entanglements that either embedding a cognitive model within an application, or embedding a simulation within a cognitive modeling environment results in.

We have explored model validation along two separate paths. One of these paths involved exploring the use of architecturally supported learning mechanisms to determine selection of information sources based on the sources that are most often useful (i.e., provide novel information). Besides freeing a production system architect from having to carefully hand-craft arbitration rules for choosing between competing knowledge, this mechanism has the added benefit of making it possible to expose shortcomings in a simulation environment. In this case, the mechanism learned to look at the displays that changed the most often.

Perhaps the most interesting findings of this modeling effort is that the dwell pattern as produced by the pilots also emerges from the model as a result of this mechanism despite not being encoded explicitly. Rather, the task demands drive information seeking, and given that the model and the pilots are performing the same tasks, the model and the pilots allocate their attention to the various visual regions of interest similarly. The combination of task driven looking and novelty driven monitoring captures the majority of the variation in the dwell pattern of the pilots (R^2=0.85) without resort to parameter fitting and model tweaking.

The actual definition of novelty is an interesting topic to pursue with future research. In this study, the out of window view only changed when the runway came into view. Thus, a continuously varying aspect of the environment is abstracted into categories that allow the straightforward determination of novelty. This is a situation that is true of the IMPRINT simulation environment we constructed, but that is not necessarily true of either the simulator the pilots used or the real airplane. For example, in both of these the visual display is constantly updated, except in IMC conditions. It is likely that the eventual solution to this problem will be to focus on rate of change, or relative amount of change as the driving factor in novelty driven monitoring of the environment.

This modeling effort has also pressed on the issue of the contrast between scripted tasks and actions and reactive tasks and actions. The overall task analysis that resulted from protocol analysis of pilot performance called for a high-level structure that consisted of two scripted sets of actions (one explicitly so, the landing checklist, the other implicitly so, placing the simulator in the pilot's desired configuration during the simulation initiation) and two reactive sets of actions (monitoring flight performance and monitoring the final approach). Our initial model of scripted actions used in this approach model is simple and not prone to errors, though we have experience with more complex models of scripted actions within the ACT-R framework that are subject to intrusions and step skipping. These more complex models do suggest that more practice is not the answer

(though it will help), but rather use of explicit physical checklists and controlling interruptions during the execution of those checklists may help reduce errors.

This contrast between scripted and reactive behaviors is also related to the errors coded during transcription of pilot protocols. Although it is common practice to use an actual printed landing checklist, the pilots in the scenarios did not use one, but rather recalled the items from memory. As an example of the kind of error that results from this, subject 5 in scenario 6 neither notifies the cabin nor arms the speed brakes. The first is an oversight, and understandable given that the pilots know there is no cabin to notify in the simulation. Despite being a standard item on landing checklists, this item was actually skipped fairly often. The second, however, is potentially more important. This omission occurred immediately after a communication from the tower interrupted the execution of the landing checklist. This suggests that one safety procedure might be to restart a landing checklist from scratch if it is interrupted in any way. In practice, the pilots in these scenarios appeared to compensate by issuing multiple exemplars of the critical commands in the landing checklist. In particular, pilots often lowered the landing gear and set the flaps to 15 as a preamble to the landing checklist, where within five seconds they would then issue the command to lower the landing gear and set the flaps to 15. This redundancy indicates that the pilots may have accumulated some experience that encouraged them to rely on some extra insurance.

Despite strategies such as this, mistakes still creep in. Subject 5, in scenario 10, after lowering the gear and setting the flaps to 15 (starting at offset of 7:01), starts to execute the landing checklist immediately afterwards (offset 7:03, just seconds later). The first item executed, however, is “speed brakes full”, rather than “speed brakes armed”. This confusion persists until, several minutes later and approaching 1000 feet, the copilot asks if “speed brakes full” is really what the pilot wants. The pilot then recovers and corrects the mistake, retracting the speed brakes and arming them for automatic deployment on landing. It may be that the simulation environment lacks the audible and tactile feedback that a real plane provides, and perhaps this mistake might never occur in real flight, but it is suggestive of the impact that confusing similar terms can have in an environment where many things are happening at the same time.

Appendix A: Protocols of Pilots Performing Approach Tasks

1-Baseline VMC vectored			
Action	delta time	actual time	
start	0:00:00	0:30:43	
engage autopilot	0:00:07	0:30:50	
LNAV	0:00:12	0:30:55	
tower comm	0:00:19	0:31:02	
ack	0:00:22	0:31:05	
set MCP altitude 3000	0:00:30	0:31:13	
VNAV	0:00:42	0:31:25	
speed brakes full	0:01:11	0:31:54	
set flaps 4	0:02:53	0:33:36	
set MCP altitude 100	0:03:55	0:34:38	
retract speed brakes	0:04:22	0:35:05	
check altitude - 3400	0:04:29	0:35:12	
check altitude - 3000	0:04:50	0:35:33	
map scale 5	0:06:53	0:37:36	
set flaps 15	0:07:03	0:37:46	
gear down	0:07:04	0:37:47	
landing checklist	0:07:05	0:37:48	
tower comm - clear to land	0:07:12	0:37:55	
ack	0:07:17	0:38:00	
gear down	0:07:22	0:38:05	
speed brakes armed	0:07:24	0:38:07	
set flaps 15	0:07:25	0:38:08	
notify cabin	0:07:26	0:38:09	
set speed 135	0:07:27	0:38:10	
check altitude - 1800	0:08:02	0:38:45	
set flaps 25	0:08:12	0:38:55	
field in sight	0:08:27	0:39:10	
set flaps 40	0:08:35	0:39:18	
check altitude - 1000	0:10:12	0:40:55	
terrain lined up	0:10:25	0:41:08	
approaching DA	0:10:29	0:41:12	
DA	0:10:40	0:41:23	
manual control - landing	0:10:43	0:41:26	

2-Baseline VMC late reassign			
Action	delta time	actual time	
start	0:00:00	1:03:00	
tower comm	0:00:20	1:03:20	
engage autopilot	0:00:30	1:03:30	
LNAV	0:00:31	1:03:31	
VNAV	0:00:32	1:03:32	
set 3000 MCP	0:00:33	1:03:33	
set speed brakes full on	0:01:06	1:04:06	
set flaps 4	0:02:08	1:05:08	
set MCP altitude 100	0:02:35	1:05:35	
set flaps 15	0:03:58	1:06:58	
retract speed brakes	0:04:42	1:07:42	
check altitude - 3300	0:04:45	1:07:45	
check altitude - 3000	0:05:15	1:08:15	
set map range 5	0:06:33	1:09:33	
gear down	0:07:28	1:10:28	
set flaps 25	0:07:28	1:10:28	
landing checklist	0:07:28	1:10:28	
tower comm	0:07:39	1:10:39	
check altitude - 2000	0:08:01	1:11:01	
check altitude - 1800	0:08:29	1:11:29	
set flaps 40	0:08:51	1:11:51	
field in sight	0:09:04	1:12:04	
tower comm sidestep	0:10:34	1:13:34	
ack	0:10:38	1:13:38	
manual control	0:10:52	1:13:52	

3-Baseline VMC missed			
Action	delta time	actual time	
start	0:00:00	1:16:10	
engage autopilot	0:00:05	1:16:15	
LNAV	0:00:06	1:16:16	
tower comm	0:00:19	1:16:29	
ack	0:00:22	1:16:32	
set MCP altitude 3000	0:00:30	1:16:40	
VNAV	0:00:40	1:16:50	
set flaps 4	0:01:20	1:17:30	
speed brakes 50%	0:02:10	1:18:20	only time for this!
set MCP altitude 1800	0:03:15	1:19:25	this is new too
retract speed brakes	0:03:52	1:20:02	
check altitude - 4500	0:04:26	1:20:36	
check altitude - 3800	0:04:52	1:21:02	
set MCP altitude 100	0:05:21	1:21:31	
map scale 5	0:06:40	1:22:50	
set flaps 15	0:07:06	1:23:16	
gear down	0:07:07	1:23:17	
landing checklist	0:07:08	1:23:18	
tower comm - clear to land	0:07:13	1:23:23	
ack	0:07:15	1:23:25	
set flaps 15	0:07:15	1:23:25	
gear down	0:07:17	1:23:27	
speed brakes armed	0:07:19	1:23:29	
set speed 135	0:07:21	1:23:31	
check altitude - 2000	0:07:25	1:23:35	
go live 1800	0:08:03	1:24:13	
VNAV annunciated	0:08:07	1:24:17	
field in sight	0:08:18	1:24:28	
set flaps 25	0:08:25	1:24:35	
set flaps 40	0:09:05	1:25:15	
check altitude - 1000	0:10:12	1:26:22	
approaching DA	0:10:31	1:26:41	
DA	0:10:40	1:26:50	
manual control - traffic on runway, going around	0:10:43	1:26:53	

4-Baseline IMC vectored			
Action	delta time	actual time	
start	0:00:00	0:40:00	
set LNAV	0:00:11	0:40:11	
set speed brakes full	0:00:12	0:40:12	
set autopilots on	0:00:13	0:40:13	
set flaps 1	0:00:14	0:40:14	
check altitude	0:00:15	0:40:15	
set flaps 15	0:02:00	0:42:00	
retract speed brakes	0:03:40	0:43:40	
set map scale 5	0:06:20	0:46:20	
gear down	0:06:30	0:46:30	
set flaps 25	0:06:30	0:46:30	
landing checklist	0:06:45	0:46:45	
tower clearance	0:06:50	0:46:50	
set flaps 40	0:08:00	0:48:00	
check altitude - 1000	0:09:40	0:49:40	
tower clear to land	0:09:45	0:49:45	
approaching DA	0:10:00	0:50:00	
field in sight	0:10:05	0:50:05	
DA	0:10:10	0:50:10	
taking over manual	0:10:10	0:50:10	

5-Baseline IMC missed			
Action	delta time	actual time	
start	0:00:00	1:25:00	
engage autopilot	0:00:04	1:25:04	
LNAV	0:00:05	1:25:05	
VNAV	0:00:06	1:25:06	
tower comm	0:00:20	1:25:20	
check altitude - 3000	0:00:33	1:25:33	
speed brakes full	0:00:40	1:25:40	
set flaps 4	0:02:58	1:27:58	
set MCP altitude 100	0:03:33	1:28:33	
set flaps 15	0:04:07	1:29:07	
retract speed brakes	0:04:10	1:29:10	
check altitude - 3200	0:04:55	1:29:55	
map scale 5	0:06:03	1:31:03	
gear down	0:07:12	1:32:12	
set flaps 25	0:07:13	1:32:13	
landing checklist	0:07:14	1:32:14	
tower comm clear to land	0:07:20	1:32:20	
check altitude - 1800	0:08:04	1:33:04	
VNAV path annunciated	0:08:06	1:33:06	
set flaps 40	0:08:24	1:33:24	
check altitude - 1000	0:10:17	1:35:17	
approaching DA	0:10:38	1:35:38	
DA	0:10:43	1:35:43	
field not in sight	0:10:46	1:35:46	
manual control - going around	0:10:49	1:35:49	

6-Baseline IMC mismatch			
Action	delta time	actual time	
start	0:00:00	0:30:43	
engage autopilot	0:00:07	0:30:50	
LNAV	0:00:12	0:30:55	
tower comm	0:00:19	0:31:02	
ack	0:00:22	0:31:05	
set MCP altitude 3000	0:00:30	0:31:13	
VNAV	0:00:42	0:31:25	
speed brakes full	0:01:11	0:31:54	
retract speed brakes	0:02:53	0:33:36	
set flaps 4	0:03:55	0:34:38	
set MCP altitude 100	0:04:22	0:35:05	
check altitude - 3900	0:04:29	0:35:12	
check altitude - 3500	0:04:50	0:35:33	
map scale 5	0:06:53	0:37:36	
set flaps 15	0:07:03	0:37:46	
gear down	0:07:04	0:37:47	
landing checklist	0:07:05	0:37:48	
tower comm - clear to land	0:07:12	0:37:55	
ack	0:07:17	0:38:00	
gear down	0:07:22	0:38:05	
set flaps 15	0:07:24	0:38:07	speed brakes not armed!
set speed 135	0:07:25	0:38:08	
check altitude - 1800	0:07:26	0:38:09	cabin not notified!
VNAV path annunciated	0:07:27	0:38:10	
set flaps 25	0:08:02	0:38:45	
set flaps 40	0:08:12	0:38:55	
check altitude - 1000	0:08:27	0:39:10	
approaching DA	0:08:35	0:39:18	
DA	0:10:12	0:40:55	
runway not lined up	0:10:25	0:41:08	
manual control - going around	0:10:29	0:41:12	

7-SVS IMC vectored			
Action	delta time	actual time	
start	0:00:00	3:27:12	
engage autopilot	0:00:03	3:27:15	
LNAV	0:00:05	3:27:17	
tower comm	0:00:13	3:27:25	
ack	0:00:18	3:27:30	
set MCP altitude 3000	0:00:24	3:27:36	
VNAV	0:00:28	3:27:40	
speed brakes full	0:00:48	3:28:00	
check altitude	0:02:26	3:29:38	
set flaps 4	0:02:28	3:29:40	
set MCP altitude 100	0:03:28	3:30:40	
retract speed brakes	0:04:20	3:31:32	
map scale 5	0:06:15	3:33:27	
set flaps 15	0:06:37	3:33:49	
gear down	0:07:00	3:34:12	
landing checklist	0:07:01	3:34:13	
gear down	0:07:02	3:34:14	
set flaps 15	0:07:04	3:34:16	
speed brakes armed	0:07:06	3:34:18	
set speed 135	0:07:08	3:34:20	
notify cabin	0:07:10	3:34:22	
tower comm - clear to land	0:07:13	3:34:25	
ack	0:07:16	3:34:28	
check altitude - 2000	0:07:18	3:34:30	
set flaps 25	0:07:42	3:34:54	
check altitude - 1800 (go live)	0:08:01	3:35:13	
set flaps 40	0:08:22	3:35:34	
check altitude - 1000	0:10:13	3:37:25	
terrain lined up	0:10:23	3:37:35	
approaching DA	0:10:28	3:37:40	
airport in sight	0:11:30	3:38:42	
runway in sight	0:11:36	3:38:48	
manual control - landing	0:11:38	3:38:50	

8-SVS IMC late reassign			
Action	delta time	actual time	
start	0:00:00	4:06:28	
engage autopilot	0:00:11	4:06:39	
LNAV	0:00:12	4:06:40	
tower comm	0:00:17	4:06:45	
ack	0:00:19	4:06:47	
set MCP altitude 3000	0:00:34	4:07:02	
VNAV	0:00:40	4:07:08	
speed brakes full	0:01:05	4:07:33	
set MCP altitude 100	0:03:43	4:10:11	
set flaps 4	0:04:03	4:10:31	
retract speed brakes	0:04:20	4:10:48	
check altitude - 3400	0:04:26	4:10:54	
check altitude - 3000	0:04:51	4:11:19	
map scale 5	0:06:24	4:12:52	
gear down	0:07:06	4:13:34	
set flaps 15	0:07:07	4:13:35	
landing checklist	0:07:08	4:13:36	
speed brakes armed	0:07:10	4:13:38	
notify cabin	0:07:12	4:13:40	
tower comm - clear to land	0:07:20	4:13:48	
ack	0:07:22	4:13:50	
set flaps 25	0:07:52	4:14:20	
set flaps 40	0:08:25	4:14:53	
check altitude - 1000	0:10:14	4:16:42	
tower comm - traffic on runway, sidestep?	0:10:15	4:16:43	
ack	0:10:21	4:16:49	
runway in sight	0:10:31	4:16:59	
manual control - landing	0:10:32	4:17:00	

9-SVS IMC missed			
Action	delta time	actual time	
start	0:00:00	2:57:35	
engage autopilot	0:00:13	2:57:48	
LNAV	0:00:14	2:57:49	
tower comm	0:00:25	2:58:00	
set MCP altitude 3000	0:00:32	2:58:07	
VNAV	0:00:35	2:58:10	
speed brakes full	0:00:50	2:58:25	
set flaps 4	0:02:30	3:00:05	
set MCP altitude 100	0:03:32	3:01:07	
retract speed brakes	0:04:12	3:01:47	
check altitude - 3500	0:04:30	3:02:05	
check altitude - 3000	0:04:55	3:02:30	
set flaps 15	0:06:27	3:04:02	
map scale 5	0:06:47	3:04:22	
tower comm clear to land	0:07:17	3:04:52	
ack	0:07:20	3:04:55	
gear down	0:07:25	3:05:00	
landing checklist	0:07:27	3:05:02	
gear down	0:07:28	3:05:03	
set flaps 15	0:07:30	3:05:05	
speed brakes armed	0:07:32	3:05:07	
set speed 135	0:07:34	3:05:09	
set flaps 25	0:07:42	3:05:17	
check altitude - 1800 (go live)	0:08:05	3:05:40	
VNAV path annunciated	0:08:07	3:05:42	
set flaps 40	0:08:19	3:05:54	
check altitude 1000	0:10:14	3:07:49	
check terrain - lined up	0:10:28	3:08:03	
approaching DA	0:10:37	3:08:12	
DA	0:10:41	3:08:16	
not in sight	0:10:43	3:08:18	
manual control - going around	0:10:44	3:08:19	

10-SVS IMC mismatch			
Action	delta time	actual time	
start	0:00:00	0:08:49	
engage autopilot	0:00:08	0:08:57	
LNAV	0:00:09	0:08:58	
tower comm	0:00:18	0:09:07	
ack	0:00:21	0:09:10	
set MCP altitude 3000	0:00:32	0:09:21	
VNAV	0:00:42	0:09:31	
speed brakes full	0:01:19	0:10:08	
set flaps 4	0:03:00	0:11:49	
set MCP altitude 100	0:04:01	0:12:50	
map scale 5	0:06:47	0:15:36	
set flaps 15	0:07:01	0:15:50	
gear down	0:07:02	0:15:51	
landing checklist	0:07:03	0:15:52	
speed brakes full	0:07:12	0:16:01	mistake!
notify cabin	0:07:21	0:16:10	
tower comm - clear to land	0:07:31	0:16:20	
ack	0:07:32	0:16:21	
check altitude - 2000	0:07:33	0:16:22	
check altitude - 1800	0:08:02	0:16:51	
VNAV annunciated	0:08:09	0:16:58	
set flaps 25	0:08:16	0:17:05	
set flaps 40	0:08:34	0:17:23	
check speedbrakes	0:08:47	0:17:36	copilot notices speedbrakes full and asks pilot
retract speedbrakes	0:08:48	0:17:37	
speed brakes armed	0:08:59	0:17:48	
check altitude - 1000	0:10:11	0:19:00	
approaching DA	0:10:30	0:19:19	
DA	0:10:34	0:19:23	
runway not aligned	0:10:35	0:19:24	
manual control - going around	0:10:36	0:19:25	

Appendix B: Model Traces

1-Baseline VMC Vectored approach

```
dribbling to file "NASA-hpm-model-results.drb"

; Fast loading
;    C:\Documents and Settings\bbest\My Documents\Completed
Projects\NASA HEM\NasaHEMv07-Jul-
2005\nasav07\HPMv7\delivery\ole\client\autotool.fasl
;   Fast loading
;      C:\Documents and Settings\bbest\My Documents\Completed
Projects\NASA HEM\NasaHEMv07-Jul-
2005\nasav07\HPMv7\delivery\ole\client\idispatch.fasl
;   Fast loading
;      C:\Documents and Settings\bbest\My Documents\Completed
Projects\NASA HEM\NasaHEMv07-Jul-
2005\nasav07\HPMv7\delivery\ole\client\iclassfactory.fasl

Factory Started
CL-USER(1): (register-server)
Resistered Server EMC_NASAHPM.EMCReceiveCOMMessages
NIL
CL-USER(2):
Subject 0 Trial 0 Run 1
Initializing control

 Control    4.913
    isa CONTROL
    speed 200.0d0
    altitude 2500.0d0
    waypoint nil
    distance nil
    flaps 5
    decision-altitude 600
    landing-gear Up
    airbrakes Off
    autopilots Engaged
    task nil
    last-task nil
    status Active
    landing-checklist nil
 VISUAL    0.000 flaps Value 5
 CHUNK NIL IS UNDEFINED.
 CHUNK NIL IS UNDEFINED.
 PROCEDURAL    2.403 Preparing for approach: setting Flaps 1
 MANUAL    2.403 flaps set 1
 PROCEDURAL    3.337 Preparing for approach: engaging Autopilot
 VISUAL    3.337 autopilots Value up
 PROCEDURAL    4.384 Preparing for approach: setting LNAV
 VISUAL    4.384 distance-next Value 1
 PROCEDURAL    5.221 Preparing for approach: setting VNAV
 VISUAL    5.221 waypoint Value 1
 PROCEDURAL    9.037 Preparing for approach: engaging Speed-brakes full
```

```
MANUAL    9.037 airbrakes on/off 0
PROCEDURAL    9.194 SubGoal checking Altitude
VISUAL   10.300 altitude Value 2500
**Goal6    5.143
   isa CHECK-ALTITUDE
   altitude 2500
   previous 2500.0d0GOAL6 NIL NIL T Ignore-Altitude
PROCEDURAL   10.957 SubGoal checking Autopilot
VISUAL   12.095 otw_runway Value out-of-sight
VISUAL   13.285 autopilots Value up
VISUAL   14.325 altitude Value 2500
**Goal8    8.629
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 2500
   decision Engaged
   decision-altitude 600GOAL8 NIL NIL T Ignore-Autopilot
PROCEDURAL   15.026 SubGoal checking Flaps
VISUAL   15.926 speed Value 200
RETRIEVAL   16.126 Flaps 1
VISUAL   17.168 flaps Value 1
PROCEDURAL   17.218 Confirm Flaps already set to 1
**Goal12    5.195
   isa SET-FLAP
   speed 200
   flap 1GOAL12 DIAL NIL NIL Flaps-Already-Set
PROCEDURAL   18.825 SubGoal checking Landing Gear
VISUAL   20.039 waypoint Value 2
VISUAL   21.264 distance-next Value 4
RETRIEVAL   21.365 Waypoint 2 Next 4 Distance 15
VISUAL   22.566 landing-gear Value up
PROCEDURAL   22.616 Lowering Gear
MANUAL   25.348 landing-gear up/down 0
**Goal15    8.795
   isa MOVE-GEAR
   waypoint 2
   distance-next 4
   distance 15
   decision DownGOAL15 DIAL DIAL T Move-Gear
PROCEDURAL   25.955 SubGoal checking Speed Brakes
VISUAL   27.021 speed Value 200
VISUAL   28.040 airbrakes Value on
**Goal20    8.690
   isa SPEED-BRAKES
   speed 200
   decision OffGOAL20 DIAL DIAL T Decide-Speed-Brakes
PROCEDURAL   28.640 SubGoal setting Dial Altitude
VISUAL   29.856 waypoint Value 2
RETRIEVAL   30.106 Altitude 1800
VISUAL   31.097 dial-altitude Value 2500
MANUAL   34.185 dial-altitude set 1800
**Goal23    5.197
   isa DIAL-ALTITUDE
   waypoint 2
   altitude 1800GOAL23 DIAL DIAL T Dial-Altitude
PROCEDURAL   34.792 SubGoal checking Speed
VISUAL   35.952 waypoint Value 2
```

```
VISUAL   36.866 distance-next Value 3
RETRIEVAL   36.966 Waypoint 2 Next 3 Distance 14
RETRIEVAL   37.266 Speed
VISUAL   38.457 dial-speed Value 200
MANUAL   40.552 dial-speed set 160
**Goal27    5.247
   isa SET-SPEED
   waypoint 2
   distance-next 3
   distance 14
   speed 160GOAL27 DIAL DIAL T Dial-Speed
PROCEDURAL   41.160 SubGoal checking Decision Altitude
VISUAL   42.080 waypoint Value 2
VISUAL   43.220 distance-next Value 2
RETRIEVAL   43.320 Waypoint 2 Next 2 Distance 13
**Goal32    4.689
   isa SET-DECISION-ALTITUDE
   waypoint 2
   distance-next 2
   distance 13
   old 600
   decision 600GOAL32 DIAL DIAL T Ignore-Decision-Altitude
PROCEDURAL   43.976 SubGoal checking Altitude
VISUAL   44.911 altitude Value 2500
**Goal35    5.319
   isa CHECK-ALTITUDE
   altitude 2500
   previous 2500GOAL35 DIAL DIAL T Ignore-Altitude
PROCEDURAL   45.567 SubGoal checking Autopilot
VISUAL   46.765 otw_runway Value out-of-sight
VISUAL   47.673 autopilots Value up
VISUAL   48.801 altitude Value 2500
**Goal37    8.366
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 2500
   decision Engaged
   decision-altitude 600GOAL37 DIAL DIAL T Ignore-Autopilot
PROCEDURAL   49.502 SubGoal checking Flaps
VISUAL   50.367 speed Value 192
RETRIEVAL   50.517 Flaps 20
VISUAL   51.526 flaps Value 1
MANUAL   53.597 flaps set 20
**Goal41    5.084
   isa SET-FLAP
   speed 192
   flap 20GOAL41 DIAL DIAL T Set-Flaps
PROCEDURAL   54.204 SubGoal checking Speed Brakes
VISUAL   55.397 speed Value 188
VISUAL   56.426 airbrakes Value on
**Goal45    8.546
   isa SPEED-BRAKES
   speed 188
   decision OffGOAL45 DIAL DIAL T Decide-Speed-Brakes
PROCEDURAL   57.026 SubGoal checking Decision Altitude
VISUAL   58.178 waypoint Value 2
VISUAL   59.250 distance-next Value 1
```

```
RETRIEVAL   59.350 Waypoint 2 Next 1 Distance 12
**Goal48    4.986
   isa SET-DECISION-ALTITUDE
   waypoint 2
   distance-next 1
   distance 12
   old 600
   decision 600GOAL48 DIAL DIAL T Ignore-Decision-Altitude
PROCEDURAL   60.005 SubGoal setting Dial Altitude
VISUAL   60.952 waypoint Value 2
RETRIEVAL   61.102 Altitude 1800
VISUAL   61.860 dial-altitude Value 1800
PROCEDURAL   61.910 Confirm Altitude already set to 1800
**Goal51    4.845
   isa DIAL-ALTITUDE
   waypoint 2
   altitude 1800GOAL51 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL   62.516 SubGoal checking Landing Gear
VISUAL   63.757 waypoint Value 2
VISUAL   64.855 distance-next Value 1
RETRIEVAL   64.955 Waypoint 2 Next 1 Distance 12
VISUAL   66.149 landing-gear Value down
**Goal54    8.556
   isa MOVE-GEAR
   waypoint 2
   distance-next 1
   distance 12
   decision DownGOAL54 DIAL DIAL T Decide-Gear
PROCEDURAL   66.749 SubGoal checking Speed
VISUAL   67.568 waypoint Value 2
VISUAL   68.846 distance-next Value 1
RETRIEVAL   68.946 Waypoint 2 Next 1 Distance 12
RETRIEVAL   69.046 Speed
VISUAL   70.154 dial-speed Value 160
MANUAL   72.841 dial-speed set 140
**Goal58    4.886
   isa SET-SPEED
   waypoint 2
   distance-next 1
   distance 12
   speed 140GOAL58 DIAL DIAL T Dial-Speed
PROCEDURAL   73.450 SubGoal checking Altitude
VISUAL   74.466 altitude Value 2500
**Goal63    5.013
   isa CHECK-ALTITUDE
   altitude 2500
   previous 2500GOAL63 DIAL DIAL T Ignore-Altitude
PROCEDURAL   75.122 SubGoal checking Speed Brakes
VISUAL   75.926 speed Value 172
VISUAL   77.204 airbrakes Value on
PROCEDURAL   77.254 Setting Speed Brakes
MANUAL   79.499 airbrakes on/off 0
**Goal65    8.164
   isa SPEED-BRAKES
   speed 172
   decision OffGOAL65 DIAL DIAL T Set-Speed-Brakes
PROCEDURAL   80.100 SubGoal checking Autopilot
```

```
VISUAL   81.330 atc Value random-listen
VISUAL   81.330 otw_runway Value out-of-sight
VISUAL   82.322 atc Value ten-miles-out
VISUAL   82.322 autopilots Value up
VISUAL   83.292 altitude Value 2465
**Goal69    8.480
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 2465
   decision Engaged
   decision-altitude 600GOAL69 DIAL DIAL T Ignore-Autopilot
PROCEDURAL   83.993 SubGoal checking Flaps
VISUAL   85.216 speed Value 164
RETRIEVAL   85.416 Flaps 15
VISUAL   86.261 flaps Value 20
MANUAL   88.486 flaps set 15
**Goal73    5.058
   isa SET-FLAP
   speed 164
   flap 15GOAL73 DIAL DIAL T Set-Flaps
PROCEDURAL   89.092 SubGoal checking Decision Altitude
VISUAL   90.091 waypoint Value 3
VISUAL   91.300 distance-next Value 1
RETRIEVAL   91.400 Waypoint 3 Next 1 Distance 10
**Goal77    4.745
   isa SET-DECISION-ALTITUDE
   waypoint 3
   distance-next 1
   distance 10
   old 600
   decision 600GOAL77 DIAL DIAL T Ignore-Decision-Altitude
PROCEDURAL   92.055 SubGoal checking Altitude
VISUAL   92.928 altitude Value 2289
**Goal80    4.936
   isa CHECK-ALTITUDE
   altitude 2289
   previous 2500GOAL80 DIAL DIAL T Read-Altitude
PROCEDURAL   93.583 SubGoal setting Dial Altitude
VISUAL   94.835 waypoint Value 3
RETRIEVAL   94.985 Altitude 1000
VISUAL   96.200 dial-altitude Value 1800
MANUAL   99.083 dial-altitude set 1000
**Goal82    5.044
   isa DIAL-ALTITUDE
   waypoint 3
   altitude 1000GOAL82 DIAL DIAL T Dial-Altitude
PROCEDURAL   99.689 SubGoal checking Speed Brakes
VISUAL  100.984 speed Value 158
VISUAL  102.293 airbrakes Value off
**Goal86    8.043
   isa SPEED-BRAKES
   speed 158
   decision OffGOAL86 DIAL DIAL T Decide-Speed-Brakes
PROCEDURAL  102.893 SubGoal checking Landing Gear
VISUAL  103.765 waypoint Value 3
VISUAL  104.973 distance-next Value 1
RETRIEVAL  105.073 Waypoint 3 Next 1 Distance 10
```

```
VISUAL  106.279 landing-gear Value down
**Goal89    8.502
   isa MOVE-GEAR
   waypoint 3
   distance-next 1
   distance 10
   decision DownGOAL89 DIAL DIAL T Decide-Gear
PROCEDURAL  106.879 SubGoal checking Altitude
VISUAL  107.989 altitude Value 2025
**Goal93    5.007
   isa CHECK-ALTITUDE
   altitude 2025
   previous 2289GOAL93 DIAL DIAL T Read-Altitude
PROCEDURAL  108.644 SubGoal checking Decision Altitude
VISUAL  109.736 waypoint Value 3
VISUAL  110.631 distance-next Value 1
RETRIEVAL  110.731 Waypoint 3 Next 1 Distance 10
**Goal95    5.150
   isa SET-DECISION-ALTITUDE
   waypoint 3
   distance-next 1
   distance 10
   old 600
   decision 600GOAL95 DIAL DIAL T Ignore-Decision-Altitude
PROCEDURAL  111.387 SubGoal checking Autopilot
VISUAL  112.401 otw_runway Value out-of-sight
VISUAL  113.250 autopilots Value up
VISUAL  114.082 altitude Value 1919
**Goal98    8.288
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1919
   decision Engaged
   decision-altitude 600GOAL98 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  114.783 SubGoal setting Dial Altitude
VISUAL  115.699 waypoint Value 3
RETRIEVAL  115.849 Altitude 1000
VISUAL  116.928 dial-altitude Value 1000
PROCEDURAL  116.978 Confirm Altitude already set to 1000
**Goal102    5.017
   isa DIAL-ALTITUDE
   waypoint 3
   altitude 1000GOAL102 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  117.585 SubGoal checking Altitude
VISUAL  118.425 altitude Value 1843
**Goal105    5.017
   isa CHECK-ALTITUDE
   altitude 1843
   previous 2025GOAL105 DIAL DIAL T Read-Altitude
PROCEDURAL  119.083 SubGoal checking Autopilot
VISUAL  120.238 otw_runway Value out-of-sight
VISUAL  121.051 autopilots Value up
VISUAL  122.222 altitude Value 1793
**Goal107    8.296
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1793
```

```
   decision Engaged
   decision-altitude 600GOAL107 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  122.923 SubGoal checking Altitude
VISUAL  124.191 altitude Value 1780
**Goal111    5.084
   isa CHECK-ALTITUDE
   altitude 1780
   previous 1843GOAL111 DIAL DIAL T Ignore-Altitude
PROCEDURAL  124.847 SubGoal setting Dial Altitude
VISUAL  125.903 waypoint Value 4
RETRIEVAL  126.053 Altitude 700
VISUAL  127.103 dial-altitude Value 1000
MANUAL  129.466 dial-altitude set 700
**Goal113    4.912
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL113 DIAL DIAL T Dial-Altitude
PROCEDURAL  130.073 SubGoal completing landing checklist
PROCEDURAL  133.235 Landing checklist: setting Speed to 135
MANUAL  133.235 speed set 135
VISUAL  133.235 speed Value 151
CHUNK NIL IS UNDEFINED.
CHUNK NIL IS UNDEFINED.
PROCEDURAL  136.271 Landing checklist: setting Gear down 1
MANUAL  136.271 landing-gear up/down 0
PROCEDURAL  139.065 Landing checklist: preparing cabin for landing
VOCAL  139.065 nothing communication 2007
PROCEDURAL  143.195 Landing checklist: setting Speed-brakes to armed
MANUAL  143.195 airbrakes on/off 0
PROCEDURAL  146.165 Landing checklist: setting Flaps 15
MANUAL  146.165 flaps set 15
VOCAL  146.215 Landing Checklist Complete
PROCEDURAL  146.370 SubGoal checking Altitude
VISUAL  147.593 altitude Value 1630
**Goal124    5.295
   isa CHECK-ALTITUDE
   altitude 1630
   previous 1780GOAL124 DIAL DIAL T Ignore-Altitude
PROCEDURAL  148.250 SubGoal checking Autopilot
VISUAL  149.388 otw_runway Value out-of-sight
VISUAL  150.416 autopilots Value up
VISUAL  151.511 altitude Value 1606
**Goal126    7.929
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1606
   decision Engaged
   decision-altitude 600GOAL126 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  152.212 SubGoal checking Altitude
VISUAL  153.152 altitude Value 1595
**Goal130    4.791
   isa CHECK-ALTITUDE
   altitude 1595
   previous 1630GOAL130 DIAL DIAL T Ignore-Altitude
PROCEDURAL  153.810 SubGoal setting Dial Altitude
VISUAL  154.796 waypoint Value 4
RETRIEVAL  154.946 Altitude 700
```

```
VISUAL  155.895 dial-altitude Value 700
PROCEDURAL  155.945 Confirm Altitude already set to 700
**Goal132    4.819
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL132 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  156.550 SubGoal checking Altitude
VISUAL  157.844 atc Value random-no-listen
VISUAL  157.844 altitude Value 1566
**Goal135    5.076
   isa CHECK-ALTITUDE
   altitude 1566
   previous 1595GOAL135 DIAL DIAL T Ignore-Altitude
PROCEDURAL  158.502 SubGoal checking Autopilot
VISUAL  159.628 otw_runway Value out-of-sight
VISUAL  160.614 autopilots Value up
VISUAL  161.883 altitude Value 1541
**Goal137    7.951
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1541
   decision Engaged
   decision-altitude 600GOAL137 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  162.584 SubGoal checking Altitude
VISUAL  163.770 altitude Value 1529
**Goal141    5.415
   isa CHECK-ALTITUDE
   altitude 1529
   previous 1566GOAL141 DIAL DIAL T Ignore-Altitude
PROCEDURAL  164.426 SubGoal setting Dial Altitude
VISUAL  165.678 waypoint Value 4
RETRIEVAL  165.828 Altitude 700
VISUAL  166.980 dial-altitude Value 700
PROCEDURAL  167.030 Confirm Altitude already set to 700
**Goal143    4.885
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL143 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  167.639 SubGoal checking Altitude
VISUAL  168.824 altitude Value 1499
**Goal146    4.867
   isa CHECK-ALTITUDE
   altitude 1499
   previous 1529GOAL146 DIAL DIAL T Ignore-Altitude
PROCEDURAL  169.481 SubGoal checking Autopilot
VISUAL  170.443 otw_runway Value out-of-sight
VISUAL  171.449 autopilots Value up
VISUAL  172.293 altitude Value 1477
**Goal148    7.714
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1477
   decision Engaged
   decision-altitude 600GOAL148 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  172.994 SubGoal checking Altitude
VISUAL  174.040 altitude Value 1466
**Goal152    4.967
```

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   isa CHECK-ALTITUDE
   altitude 1466
   previous 1499GOAL152 DIAL DIAL T Ignore-Altitude
PROCEDURAL  174.699 SubGoal setting Dial Altitude
VISUAL  175.829 waypoint Value 4
RETRIEVAL  175.979 Altitude 700
VISUAL  176.809 dial-altitude Value 700
PROCEDURAL  176.859 Confirm Altitude already set to 700
**Goal154    4.882
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL154 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  177.466 SubGoal checking Altitude
VISUAL  178.456 altitude Value 1440
**Goal157    4.800
   isa CHECK-ALTITUDE
   altitude 1440
   previous 1466GOAL157 DIAL DIAL T Ignore-Altitude
PROCEDURAL  179.113 SubGoal checking Autopilot
VISUAL  180.124 otw_runway Value out-of-sight
VISUAL  181.280 autopilots Value up
VISUAL  182.341 altitude Value 1416
**Goal159    7.907
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1416
   decision Engaged
   decision-altitude 600GOAL159 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  183.042 SubGoal checking Altitude
VISUAL  184.266 altitude Value 1405
**Goal163    4.964
   isa CHECK-ALTITUDE
   altitude 1405
   previous 1440GOAL163 DIAL DIAL T Ignore-Altitude
PROCEDURAL  184.924 SubGoal setting Dial Altitude
VISUAL  185.925 waypoint Value 4
RETRIEVAL  186.075 Altitude 700
VISUAL  186.901 dial-altitude Value 700
PROCEDURAL  186.951 Confirm Altitude already set to 700
**Goal165    5.025
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL165 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  187.557 SubGoal checking Altitude
VISUAL  188.846 altitude Value 1377
**Goal168    4.849
   isa CHECK-ALTITUDE
   altitude 1377
   previous 1405GOAL168 DIAL DIAL T Ignore-Altitude
PROCEDURAL  189.501 SubGoal setting Dial Altitude
VISUAL  190.517 waypoint Value 4
RETRIEVAL  190.667 Altitude 700
VISUAL  191.511 dial-altitude Value 700
PROCEDURAL  191.561 Confirm Altitude already set to 700
**Goal170    5.245
   isa DIAL-ALTITUDE
   waypoint 4
```

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   altitude 700GOAL170 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  192.167 SubGoal checking Altitude
VISUAL  193.232 altitude Value 1352
**Goal173    4.898
   isa CHECK-ALTITUDE
   altitude 1352
   previous 1377GOAL173 DIAL DIAL T Ignore-Altitude
PROCEDURAL  193.888 SubGoal checking Autopilot
VISUAL  195.188 otw_runway Value out-of-sight
VISUAL  195.993 autopilots Value up
VISUAL  196.958 altitude Value 1329
**Goal175    7.855
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1329
   decision Engaged
   decision-altitude 600GOAL175 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  197.660 SubGoal checking Altitude
VISUAL  198.654 altitude Value 1319
**Goal179    5.177
   isa CHECK-ALTITUDE
   altitude 1319
   previous 1352GOAL179 DIAL DIAL T Ignore-Altitude
PROCEDURAL  199.310 SubGoal setting Dial Altitude
VISUAL  200.350 waypoint Value 4
RETRIEVAL  200.500 Altitude 700
VISUAL  201.375 dial-altitude Value 700
PROCEDURAL  201.425 Confirm Altitude already set to 700
**Goal181    4.920
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL181 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  202.031 SubGoal checking Altitude
VISUAL  203.283 altitude Value 1291
**Goal184    5.144
   isa CHECK-ALTITUDE
   altitude 1291
   previous 1319GOAL184 DIAL DIAL T Ignore-Altitude
PROCEDURAL  203.941 SubGoal setting Dial Altitude
VISUAL  205.122 waypoint Value 4
RETRIEVAL  205.272 Altitude 700
VISUAL  206.496 dial-altitude Value 700
PROCEDURAL  206.546 Confirm Altitude already set to 700
**Goal186    5.011
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL186 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  207.153 SubGoal checking Altitude
VISUAL  208.173 altitude Value 1262
**Goal189    5.053
   isa CHECK-ALTITUDE
   altitude 1262
   previous 1291GOAL189 DIAL DIAL T Ignore-Altitude
PROCEDURAL  208.830 SubGoal setting Dial Altitude
VISUAL  209.646 waypoint Value 4
RETRIEVAL  209.796 Altitude 700
VISUAL  210.864 dial-altitude Value 700
```

```
PROCEDURAL  210.914 Confirm Altitude already set to 700
**Goal191    4.858
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL191 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  211.522 SubGoal checking Altitude
VISUAL  212.373 altitude Value 1237
**Goal194    5.219
   isa CHECK-ALTITUDE
   altitude 1237
   previous 1262GOAL194 DIAL DIAL T Ignore-Altitude
PROCEDURAL  213.030 SubGoal setting Dial Altitude
VISUAL  214.053 waypoint Value 4
RETRIEVAL  214.203 Altitude 700
VISUAL  215.175 dial-altitude Value 700
PROCEDURAL  215.225 Confirm Altitude already set to 700
**Goal196    5.177
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL196 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  215.832 SubGoal checking Altitude
VISUAL  216.839 altitude Value 1211
**Goal199    5.158
   isa CHECK-ALTITUDE
   altitude 1211
   previous 1237GOAL199 DIAL DIAL T Ignore-Altitude
PROCEDURAL  217.497 SubGoal checking Autopilot
VISUAL  218.542 otw_runway Value out-of-sight
VISUAL  219.434 autopilots Value up
VISUAL  220.406 altitude Value 1189
**Goal201    7.916
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1189
   decision Engaged
   decision-altitude 600GOAL201 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  221.107 SubGoal checking Altitude
VISUAL  222.387 altitude Value 1177
**Goal205    4.981
   isa CHECK-ALTITUDE
   altitude 1177
   previous 1211GOAL205 DIAL DIAL T Ignore-Altitude
PROCEDURAL  223.044 SubGoal setting Dial Altitude
VISUAL  224.153 waypoint Value 4
RETRIEVAL  224.303 Altitude 700
VISUAL  225.429 dial-altitude Value 700
PROCEDURAL  225.479 Confirm Altitude already set to 700
**Goal207    4.934
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL207 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  226.083 SubGoal checking Altitude
VISUAL  227.047 altitude Value 1149
**Goal210    4.596
   isa CHECK-ALTITUDE
   altitude 1149
   previous 1177GOAL210 DIAL DIAL T Ignore-Altitude
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PROCEDURAL  227.703 SubGoal checking Autopilot
VISUAL  228.562 otw_runway Value out-of-sight
VISUAL  229.572 autopilots Value up
VISUAL  230.626 altitude Value 1128
**Goal212    7.555
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1128
   decision Engaged
   decision-altitude 600GOAL212 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  231.328 SubGoal checking Altitude
VISUAL  232.618 altitude Value 1116
**Goal216    4.990
   isa CHECK-ALTITUDE
   altitude 1116
   previous 1149GOAL216 DIAL DIAL T Ignore-Altitude
PROCEDURAL  233.275 SubGoal setting Dial Altitude
VISUAL  234.348 waypoint Value 4
RETRIEVAL  234.498 Altitude 700
VISUAL  235.650 dial-altitude Value 700
PROCEDURAL  235.700 Confirm Altitude already set to 700
**Goal218    4.851
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL218 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  236.307 SubGoal checking Altitude
VISUAL  237.234 altitude Value 1089
**Goal221    5.098
   isa CHECK-ALTITUDE
   altitude 1089
   previous 1116GOAL221 DIAL DIAL T Ignore-Altitude
PROCEDURAL  237.890 SubGoal setting Dial Altitude
VISUAL  238.779 waypoint Value 4
RETRIEVAL  238.929 Altitude 700
VISUAL  239.694 dial-altitude Value 700
PROCEDURAL  239.744 Confirm Altitude already set to 700
**Goal223    4.900
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL223 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  240.350 SubGoal checking Altitude
VISUAL  241.250 atc Value random-listen
VISUAL  241.250 altitude Value 1064
**Goal226    4.429
   isa CHECK-ALTITUDE
   altitude 1064
   previous 1089GOAL226 DIAL DIAL T Ignore-Altitude
PROCEDURAL  241.905 SubGoal setting Dial Altitude
VISUAL  243.166 waypoint Value 4
RETRIEVAL  243.316 Altitude 700
VISUAL  244.187 dial-altitude Value 700
PROCEDURAL  244.237 Confirm Altitude already set to 700
**Goal228    5.316
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL228 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  244.846 SubGoal checking Altitude
```

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VISUAL  245.740 altitude Value 1038
**Goal231    5.003
   isa CHECK-ALTITUDE
   altitude 1038
   previous 1064GOAL231 DIAL DIAL T Ignore-Altitude
PROCEDURAL  246.397 SubGoal setting Dial Altitude
VISUAL  247.508 waypoint Value 4
RETRIEVAL  247.658 Altitude 700
VISUAL  248.420 dial-altitude Value 700
PROCEDURAL  248.470 Confirm Altitude already set to 700
**Goal233    5.088
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL233 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  249.077 SubGoal checking Altitude
VISUAL  250.070 altitude Value 1012
**Goal236    5.131
   isa CHECK-ALTITUDE
   altitude 1012
   previous 1038GOAL236 DIAL DIAL T Ignore-Altitude
PROCEDURAL  250.725 SubGoal setting Dial Altitude
VISUAL  251.605 waypoint Value 4
RETRIEVAL  251.755 Altitude 700
VISUAL  252.576 dial-altitude Value 700
PROCEDURAL  252.626 Confirm Altitude already set to 700
**Goal238    4.798
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL238 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  253.234 SubGoal checking Altitude
VISUAL  254.412 altitude Value 968
**Goal241    4.991
   isa CHECK-ALTITUDE
   altitude 968
   previous 1012GOAL241 DIAL DIAL T Ignore-Altitude
PROCEDURAL  255.070 SubGoal setting Dial Altitude
VISUAL  256.154 waypoint Value 5
RETRIEVAL  256.304 Altitude 500
VISUAL  257.521 dial-altitude Value 700
MANUAL  260.247 dial-altitude set 500
**Goal243    5.025
   isa DIAL-ALTITUDE
   waypoint 5
   altitude 500GOAL243 DIAL DIAL T Dial-Altitude
PROCEDURAL  260.854 SubGoal checking Altitude
VISUAL  262.129 altitude Value 865
**Goal247    4.857
   isa CHECK-ALTITUDE
   altitude 865
   previous 968GOAL247 DIAL DIAL T Ignore-Altitude
PROCEDURAL  262.783 SubGoal setting Dial Altitude
VISUAL  263.808 waypoint Value 5
RETRIEVAL  263.958 Altitude 500
VISUAL  265.174 dial-altitude Value 500
PROCEDURAL  265.224 Confirm Altitude already set to 500
**Goal249    4.898
   isa DIAL-ALTITUDE
```

```
   waypoint 5
   altitude 500GOAL249 DIAL DIAL T Dial-Altitude-Already-Dialed
 PROCEDURAL  265.830 SubGoal checking Altitude
 VISUAL  267.101 altitude Value 798
 **Goal252    5.003
   isa CHECK-ALTITUDE
   altitude 798
   previous 865GOAL252 DIAL DIAL T Ignore-Altitude
 PROCEDURAL  267.755 SubGoal checking Autopilot
 VISUAL  268.997 otw_runway Value in-sight
 VISUAL  270.073 autopilots Value up
 PROCEDURAL  270.123 Disengage Autopilot and land
 MANUAL  272.340 autopilots up/down 0
 **Goal254    9.872
   isa SET-AUTOPILOT
   visibility In-Sight
   peek nil
   decision Disengaged
   decision-altitude 600GOAL254 DIAL DIAL T Disengage-Autopilot


*** Finis  ***


*** Setting ModelDone to 1***

 MCP NAV PFD SVS CONTROLS OTW off Total-time
 22.38712 109.033844 80.619064 0 19.517712 21.83604 19.501144 272.89493
EMC End:T 272.89493

Look 1.0 Action 2.5 Listen 0.5 Ans 0.1


;; Factory is idle.
```

2-Baseline VMC Late reassignment (land on parallel runway)

```
dribbling to file "NASA-hpm-model-results.drb"

; Fast loading
;    C:\Documents and Settings\bbest\My Documents\Completed
Projects\NASA HEM\NasaHEMv07-Jul-
2005\nasav07\HPMv7\delivery\ole\client\autotool.fasl
;   Fast loading
;      C:\Documents and Settings\bbest\My Documents\Completed
Projects\NASA HEM\NasaHEMv07-Jul-
2005\nasav07\HPMv7\delivery\ole\client\idispatch.fasl
;   Fast loading
;      C:\Documents and Settings\bbest\My Documents\Completed
Projects\NASA HEM\NasaHEMv07-Jul-
2005\nasav07\HPMv7\delivery\ole\client\iclassfactory.fasl

Factory Started
CL-USER(1): (register-server)
Resistered Server EMC_NASAHPM.EMCReceiveCOMMessages
NIL
CL-USER(2):
Subject 0 Trial 0 Run 1
Initializing control

 Control    5.107
    isa CONTROL
    speed 200.0d0
    altitude 2500.0d0
    waypoint nil
    distance nil
    flaps 5
    decision-altitude 600
    landing-gear Up
    airbrakes Off
    autopilots Engaged
    task nil
    last-task nil
    status Active
    landing-checklist nil
 VISUAL    0.000 flaps Value 5
 CHUNK NIL IS UNDEFINED.
 CHUNK NIL IS UNDEFINED.
 PROCEDURAL    1.173 Preparing for approach: setting LNAV
 VISUAL    1.173 distance-next Value 1
 PROCEDURAL    4.862 Preparing for approach: engaging Speed-brakes full
 MANUAL    4.862 airbrakes on/off 0
 PROCEDURAL    5.772 Preparing for approach: setting VNAV
 VISUAL    5.772 waypoint Value 1
 PROCEDURAL    6.870 Preparing for approach: engaging Autopilot
 VISUAL    6.870 autopilots Value up
 PROCEDURAL    9.249 Preparing for approach: setting Flaps 1
 MANUAL    9.249 flaps set 1
 PROCEDURAL    9.407 SubGoal checking Altitude
 VISUAL   10.438 altitude Value 2500
 **Goal6    5.340
```

```
   isa CHECK-ALTITUDE
   altitude 2500
   previous 2500.0d0GOAL6 NIL NIL T Ignore-Altitude
PROCEDURAL   11.095 SubGoal checking Speed
VISUAL   12.371 waypoint Value 1
VISUAL   13.434 distance-next Value 0
RETRIEVAL   13.534 Waypoint 1 Next 0 Distance 15
RETRIEVAL   13.634 Speed
VISUAL   14.467 dial-speed Value 200
MANUAL   17.042 dial-speed set 160
**Goal8    4.729
   isa SET-SPEED
   waypoint 1
   distance-next 0
   distance 15
   speed 160GOAL8 DIAL DIAL T Dial-Speed
PROCEDURAL   17.649 SubGoal checking Decision Altitude
VISUAL   18.697 waypoint Value 2
VISUAL   19.873 distance-next Value 4
RETRIEVAL   19.974 Waypoint 2 Next 4 Distance 15
**Goal13    5.182
   isa SET-DECISION-ALTITUDE
   waypoint 2
   distance-next 4
   distance 15
   old 600
   decision 600GOAL13 DIAL DIAL T Ignore-Decision-Altitude
PROCEDURAL   20.630 SubGoal checking Speed Brakes
VISUAL   21.592 speed Value 196
VISUAL   22.581 airbrakes Value on
PROCEDURAL   22.631 Setting Speed Brakes
MANUAL   24.703 airbrakes on/off 0
**Goal16    8.429
   isa SPEED-BRAKES
   speed 196
   decision OffGOAL16 DIAL DIAL T Set-Speed-Brakes
PROCEDURAL   25.303 SubGoal setting Dial Altitude
VISUAL   26.476 waypoint Value 2
RETRIEVAL   26.676 Altitude 1800
VISUAL   27.609 dial-altitude Value 2500
MANUAL   29.817 dial-altitude set 1800
**Goal20    5.039
   isa DIAL-ALTITUDE
   waypoint 2
   altitude 1800GOAL20 DIAL DIAL T Dial-Altitude
PROCEDURAL   30.421 SubGoal checking Flaps
VISUAL   31.333 speed Value 189
RETRIEVAL   31.533 Flaps 25
VISUAL   32.334 flaps Value 1
MANUAL   35.357 flaps set 25
**Goal24    5.101
   isa SET-FLAP
   speed 189
   flap 25GOAL24 DIAL DIAL T Set-Flaps
PROCEDURAL   35.964 SubGoal checking Autopilot
VISUAL   37.155 otw_runway Value out-of-sight
VISUAL   37.989 autopilots Value up
```

```
VISUAL   39.285 altitude Value 2500
**Goal28    8.758
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 2500
   decision Engaged
   decision-altitude 600GOAL28 DIAL DIAL T Ignore-Autopilot
PROCEDURAL   39.986 SubGoal checking Landing Gear
VISUAL   40.954 waypoint Value 2
VISUAL   42.239 distance-next Value 2
RETRIEVAL   42.339 Waypoint 2 Next 2 Distance 13
VISUAL   43.388 landing-gear Value up
PROCEDURAL   43.438 Lowering Gear
MANUAL   45.995 landing-gear up/down 0
**Goal32    8.906
   isa MOVE-GEAR
   waypoint 2
   distance-next 2
   distance 13
   decision DownGOAL32 DIAL DIAL T Move-Gear
PROCEDURAL   46.602 SubGoal checking Altitude
VISUAL   47.489 altitude Value 2500
**Goal37    4.601
   isa CHECK-ALTITUDE
   altitude 2500
   previous 2500GOAL37 DIAL DIAL T Ignore-Altitude
PROCEDURAL   48.145 SubGoal checking Decision Altitude
VISUAL   49.235 waypoint Value 2
VISUAL   50.268 distance-next Value 2
RETRIEVAL   50.368 Waypoint 2 Next 2 Distance 13
**Goal39    4.817
   isa SET-DECISION-ALTITUDE
   waypoint 2
   distance-next 2
   distance 13
   old 600
   decision 600GOAL39 DIAL DIAL T Ignore-Decision-Altitude
PROCEDURAL   51.024 SubGoal checking Speed Brakes
VISUAL   52.077 speed Value 172
VISUAL   53.214 airbrakes Value off
**Goal42    8.730
   isa SPEED-BRAKES
   speed 172
   decision OffGOAL42 DIAL DIAL T Decide-Speed-Brakes
PROCEDURAL   53.814 SubGoal checking Speed
VISUAL   55.073 waypoint Value 2
VISUAL   56.130 distance-next Value 2
RETRIEVAL   56.230 Waypoint 2 Next 2 Distance 13
RETRIEVAL   56.330 Speed
VISUAL   57.267 dial-speed Value 160
MANUAL   59.973 dial-speed set 165
**Goal45    4.866
   isa SET-SPEED
   waypoint 2
   distance-next 2
   distance 13
   speed 165GOAL45 DIAL DIAL T Dial-Speed
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PROCEDURAL   60.580 SubGoal setting Dial Altitude
VISUAL   61.825 waypoint Value 2
RETRIEVAL   62.025 Altitude 1800
VISUAL   62.822 dial-altitude Value 1800
PROCEDURAL   62.872 Confirm Altitude already set to 1800
**Goal50    5.005
   isa DIAL-ALTITUDE
   waypoint 2
   altitude 1800GOAL50 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL   63.478 SubGoal checking Autopilot
VISUAL   64.473 otw_runway Value out-of-sight
VISUAL   65.581 autopilots Value up
VISUAL   66.522 altitude Value 2500
**Goal53    8.438
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 2500
   decision Engaged
   decision-altitude 600GOAL53 DIAL DIAL T Ignore-Autopilot
PROCEDURAL   67.223 SubGoal checking Flaps
VISUAL   68.167 speed Value 165
RETRIEVAL   68.317 Flaps 15
VISUAL   69.371 flaps Value 25
MANUAL   71.866 flaps set 15
**Goal57    4.673
   isa SET-FLAP
   speed 165
   flap 15GOAL57 DIAL DIAL T Set-Flaps
PROCEDURAL   72.473 SubGoal checking Landing Gear
VISUAL   73.345 waypoint Value 2
VISUAL   74.357 distance-next Value 1
RETRIEVAL   74.457 Waypoint 2 Next 1 Distance 12
VISUAL   75.421 landing-gear Value down
**Goal61    8.420
   isa MOVE-GEAR
   waypoint 2
   distance-next 1
   distance 12
   decision DownGOAL61 DIAL DIAL T Decide-Gear
PROCEDURAL   76.021 SubGoal checking Altitude
VISUAL   76.867 altitude Value 2500
**Goal65    4.974
   isa CHECK-ALTITUDE
   altitude 2500
   previous 2500GOAL65 DIAL DIAL T Ignore-Altitude
PROCEDURAL   77.525 SubGoal checking Decision Altitude
VISUAL   78.602 waypoint Value 2
VISUAL   79.529 distance-next Value 0
RETRIEVAL   79.629 Waypoint 2 Next 0 Distance 11
**Goal67    5.059
   isa SET-DECISION-ALTITUDE
   waypoint 2
   distance-next 0
   distance 11
   old 600
   decision 600GOAL67 DIAL DIAL T Ignore-Decision-Altitude
PROCEDURAL   80.286 SubGoal checking Speed Brakes
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```
VISUAL   81.112 atc Value random-listen
VISUAL   81.112 speed Value 165
VISUAL   82.140 airbrakes Value off
**Goal70    8.341
   isa SPEED-BRAKES
   speed 165
   decision OffGOAL70 DIAL DIAL T Decide-Speed-Brakes
PROCEDURAL   82.740 SubGoal setting Dial Altitude
VISUAL   83.707 waypoint Value 2
RETRIEVAL   83.857 Altitude 1800
VISUAL   84.628 dial-altitude Value 1800
PROCEDURAL   84.678 Confirm Altitude already set to 1800
**Goal73    5.011
   isa DIAL-ALTITUDE
   waypoint 2
   altitude 1800GOAL73 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL   85.285 SubGoal checking Altitude
VISUAL   86.470 atc Value ten-miles-out
VISUAL   86.470 altitude Value 2498
**Goal76    5.052
   isa CHECK-ALTITUDE
   altitude 2498
   previous 2500GOAL76 DIAL DIAL T Ignore-Altitude
PROCEDURAL   87.128 SubGoal checking Autopilot
VISUAL   88.327 otw_runway Value out-of-sight
VISUAL   89.232 autopilots Value up
VISUAL   90.448 altitude Value 2424
**Goal78    8.494
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 2424
   decision Engaged
   decision-altitude 600GOAL78 DIAL DIAL T Ignore-Autopilot
PROCEDURAL   91.149 SubGoal checking Decision Altitude
VISUAL   91.979 waypoint Value 3
VISUAL   93.029 distance-next Value 2
RETRIEVAL   93.129 Waypoint 3 Next 2 Distance 11
**Goal82    5.221
   isa SET-DECISION-ALTITUDE
   waypoint 3
   distance-next 2
   distance 11
   old 600
   decision 600GOAL82 DIAL DIAL T Ignore-Decision-Altitude
PROCEDURAL   93.787 SubGoal checking Flaps
VISUAL   94.844 speed Value 165
RETRIEVAL   94.995 Flaps 25
VISUAL   95.932 flaps Value 15
MANUAL   97.999 flaps set 25
**Goal85    4.962
   isa SET-FLAP
   speed 165
   flap 25GOAL85 DIAL DIAL T Set-Flaps
PROCEDURAL   98.604 SubGoal checking Speed Brakes
VISUAL   99.604 speed Value 165
VISUAL  100.680 airbrakes Value off
**Goal89    8.058
```

```
   isa SPEED-BRAKES
   speed 165
   decision OffGOAL89 DIAL DIAL T Decide-Speed-Brakes
PROCEDURAL  101.280 SubGoal checking Altitude
VISUAL  102.080 altitude Value 2210
**Goal92    5.227
   isa CHECK-ALTITUDE
   altitude 2210
   previous 2498GOAL92 DIAL DIAL T Read-Altitude
PROCEDURAL  102.737 SubGoal checking Landing Gear
VISUAL  103.592 waypoint Value 3
VISUAL  104.615 distance-next Value 1
RETRIEVAL  104.715 Waypoint 3 Next 1 Distance 10
VISUAL  105.669 landing-gear Value down
**Goal94    8.580
   isa MOVE-GEAR
   waypoint 3
   distance-next 1
   distance 10
   decision DownGOAL94 DIAL DIAL T Decide-Gear
PROCEDURAL  106.269 SubGoal checking Speed
VISUAL  107.294 waypoint Value 3
VISUAL  108.398 distance-next Value 1
RETRIEVAL  108.498 Waypoint 3 Next 1 Distance 10
RETRIEVAL  108.598 Speed
VISUAL  109.723 dial-speed Value 165
MANUAL  111.747 dial-speed set 140
**Goal98    5.052
   isa SET-SPEED
   waypoint 3
   distance-next 1
   distance 10
   speed 140GOAL98 DIAL DIAL T Dial-Speed
PROCEDURAL  112.356 SubGoal checking Decision Altitude
VISUAL  113.637 waypoint Value 3
VISUAL  114.799 distance-next Value 1
RETRIEVAL  114.899 Waypoint 3 Next 1 Distance 10
**Goal103    5.205
   isa SET-DECISION-ALTITUDE
   waypoint 3
   distance-next 1
   distance 10
   old 600
   decision 600GOAL103 DIAL DIAL T Ignore-Decision-Altitude
PROCEDURAL  115.557 SubGoal setting Dial Altitude
VISUAL  116.824 waypoint Value 3
RETRIEVAL  116.974 Altitude 1000
VISUAL  117.938 dial-altitude Value 1800
MANUAL  120.310 dial-altitude set 1000
**Goal106    4.894
   isa DIAL-ALTITUDE
   waypoint 3
   altitude 1000GOAL106 DIAL DIAL T Dial-Altitude
PROCEDURAL  120.914 SubGoal checking Altitude
VISUAL  121.912 altitude Value 1849
**Goal110    5.172
   isa CHECK-ALTITUDE
```

```
   altitude 1849
   previous 2210GOAL110 DIAL DIAL T Read-Altitude
PROCEDURAL  122.568 SubGoal checking Autopilot
VISUAL  123.840 otw_runway Value out-of-sight
VISUAL  124.828 autopilots Value up
VISUAL  125.887 altitude Value 1792
**Goal112    8.183
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1792
   decision Engaged
   decision-altitude 600GOAL112 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  126.588 SubGoal checking Altitude
VISUAL  127.745 altitude Value 1780
**Goal116    5.138
   isa CHECK-ALTITUDE
   altitude 1780
   previous 1849GOAL116 DIAL DIAL T Ignore-Altitude
PROCEDURAL  128.401 SubGoal setting Dial Altitude
VISUAL  129.272 waypoint Value 4
RETRIEVAL  129.422 Altitude 700
VISUAL  130.405 dial-altitude Value 1000
MANUAL  133.262 dial-altitude set 700
**Goal118    4.777
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL118 DIAL DIAL T Dial-Altitude
PROCEDURAL  133.871 SubGoal completing landing checklist
PROCEDURAL  136.612 Landing checklist: setting Gear down 1
MANUAL  136.612 landing-gear up/down 0
PROCEDURAL  139.233 Landing checklist: setting Speed to 135
MANUAL  139.233 speed set 135
VISUAL  139.233 speed Value 155
CHUNK NIL IS UNDEFINED.
CHUNK NIL IS UNDEFINED.
PROCEDURAL  142.348 Landing checklist: setting Speed-brakes to armed
MANUAL  142.348 airbrakes on/off 0
PROCEDURAL  144.616 Landing checklist: setting Flaps 15
MANUAL  144.616 flaps set 15
PROCEDURAL  146.977 Landing checklist: preparing cabin for landing
VOCAL  146.977 nothing communication 2007
VOCAL  147.027 Landing Checklist Complete
PROCEDURAL  147.183 SubGoal checking Altitude
VISUAL  148.457 altitude Value 1642
**Goal129    4.857
   isa CHECK-ALTITUDE
   altitude 1642
   previous 1780GOAL129 DIAL DIAL T Ignore-Altitude
PROCEDURAL  149.117 SubGoal checking Autopilot
VISUAL  150.265 otw_runway Value out-of-sight
VISUAL  151.469 autopilots Value up
VISUAL  152.430 altitude Value 1617
**Goal131    8.008
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1617
   decision Engaged
```

```
   decision-altitude 600GOAL131 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  153.131 SubGoal checking Altitude
VISUAL  154.027 altitude Value 1606
**Goal135    4.971
   isa CHECK-ALTITUDE
   altitude 1606
   previous 1642GOAL135 DIAL DIAL T Ignore-Altitude
PROCEDURAL  154.686 SubGoal checking Autopilot
VISUAL  155.660 otw_runway Value out-of-sight
VISUAL  156.659 autopilots Value up
VISUAL  157.489 altitude Value 1584
**Goal137    8.343
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1584
   decision Engaged
   decision-altitude 600GOAL137 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  158.191 SubGoal checking Altitude
VISUAL  159.077 atc Value random-no-listen
VISUAL  159.077 altitude Value 1573
**Goal141    5.270
   isa CHECK-ALTITUDE
   altitude 1573
   previous 1606GOAL141 DIAL DIAL T Ignore-Altitude
PROCEDURAL  159.735 SubGoal setting Dial Altitude
VISUAL  160.722 waypoint Value 4
RETRIEVAL  160.872 Altitude 700
VISUAL  162.050 dial-altitude Value 700
PROCEDURAL  162.100 Confirm Altitude already set to 700
**Goal143    4.952
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL143 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  162.706 SubGoal checking Altitude
VISUAL  163.719 altitude Value 1544
**Goal146    4.965
   isa CHECK-ALTITUDE
   altitude 1544
   previous 1573GOAL146 DIAL DIAL T Ignore-Altitude
PROCEDURAL  164.377 SubGoal checking Autopilot
VISUAL  165.667 otw_runway Value out-of-sight
VISUAL  166.869 autopilots Value up
VISUAL  168.137 altitude Value 1515
**Goal148    7.800
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1515
   decision Engaged
   decision-altitude 600GOAL148 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  168.838 SubGoal checking Altitude
VISUAL  170.123 altitude Value 1503
**Goal152    4.971
   isa CHECK-ALTITUDE
   altitude 1503
   previous 1544GOAL152 DIAL DIAL T Ignore-Altitude
PROCEDURAL  170.782 SubGoal setting Dial Altitude
VISUAL  171.927 waypoint Value 4
```

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RETRIEVAL  172.077 Altitude 700
VISUAL  172.952 dial-altitude Value 700
PROCEDURAL  173.002 Confirm Altitude already set to 700
**Goal154    4.810
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL154 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  173.618 SubGoal checking Altitude
VISUAL  174.847 altitude Value 1473
**Goal157    5.051
   isa CHECK-ALTITUDE
   altitude 1473
   previous 1503GOAL157 DIAL DIAL T Ignore-Altitude
PROCEDURAL  175.505 SubGoal setting Dial Altitude
VISUAL  176.556 waypoint Value 4
RETRIEVAL  176.756 Altitude 700
VISUAL  177.908 dial-altitude Value 700
PROCEDURAL  177.958 Confirm Altitude already set to 700
**Goal159    4.948
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL159 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  178.565 SubGoal checking Altitude
VISUAL  179.811 altitude Value 1442
**Goal162    4.991
   isa CHECK-ALTITUDE
   altitude 1442
   previous 1473GOAL162 DIAL DIAL T Ignore-Altitude
PROCEDURAL  180.468 SubGoal checking Autopilot
VISUAL  181.636 otw_runway Value out-of-sight
VISUAL  182.865 autopilots Value up
VISUAL  183.769 altitude Value 1417
**Goal164    8.052
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1417
   decision Engaged
   decision-altitude 600GOAL164 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  184.470 SubGoal checking Altitude
VISUAL  185.360 altitude Value 1407
**Goal168    4.671
   isa CHECK-ALTITUDE
   altitude 1407
   previous 1442GOAL168 DIAL DIAL T Ignore-Altitude
PROCEDURAL  186.019 SubGoal setting Dial Altitude
VISUAL  186.837 waypoint Value 4
RETRIEVAL  186.987 Altitude 700
VISUAL  188.094 dial-altitude Value 700
PROCEDURAL  188.144 Confirm Altitude already set to 700
**Goal170    5.095
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL170 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  188.756 SubGoal checking Altitude
VISUAL  189.743 altitude Value 1380
**Goal173    4.694
   isa CHECK-ALTITUDE
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   altitude 1380
   previous 1407GOAL173 DIAL DIAL T Ignore-Altitude
PROCEDURAL  190.400 SubGoal setting Dial Altitude
VISUAL  191.213 waypoint Value 4
RETRIEVAL  191.363 Altitude 700
VISUAL  192.300 dial-altitude Value 700
PROCEDURAL  192.350 Confirm Altitude already set to 700
**Goal175    5.040
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL175 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  192.957 SubGoal checking Altitude
VISUAL  194.183 altitude Value 1353
**Goal178    5.071
   isa CHECK-ALTITUDE
   altitude 1353
   previous 1380GOAL178 DIAL DIAL T Ignore-Altitude
PROCEDURAL  194.839 SubGoal setting Dial Altitude
VISUAL  195.844 waypoint Value 4
RETRIEVAL  195.994 Altitude 700
VISUAL  196.891 dial-altitude Value 700
PROCEDURAL  196.941 Confirm Altitude already set to 700
**Goal180    5.228
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL180 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  197.548 SubGoal checking Altitude
VISUAL  198.470 altitude Value 1327
**Goal183    4.905
   isa CHECK-ALTITUDE
   altitude 1327
   previous 1353GOAL183 DIAL DIAL T Ignore-Altitude
PROCEDURAL  199.126 SubGoal checking Autopilot
VISUAL  200.381 otw_runway Value out-of-sight
VISUAL  201.620 autopilots Value up
VISUAL  202.793 altitude Value 1300
**Goal185    7.999
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1300
   decision Engaged
   decision-altitude 600GOAL185 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  203.494 SubGoal checking Altitude
VISUAL  204.321 altitude Value 1291
**Goal189    4.984
   isa CHECK-ALTITUDE
   altitude 1291
   previous 1327GOAL189 DIAL DIAL T Ignore-Altitude
PROCEDURAL  204.977 SubGoal setting Dial Altitude
VISUAL  206.083 waypoint Value 4
RETRIEVAL  206.233 Altitude 700
VISUAL  207.449 dial-altitude Value 700
PROCEDURAL  207.499 Confirm Altitude already set to 700
**Goal191    5.099
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL191 DIAL DIAL T Dial-Altitude-Already-Dialed
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PROCEDURAL  208.106 SubGoal checking Altitude
VISUAL  209.356 altitude Value 1261
**Goal194    5.114
   isa CHECK-ALTITUDE
   altitude 1261
   previous 1291GOAL194 DIAL DIAL T Ignore-Altitude
PROCEDURAL  210.013 SubGoal setting Dial Altitude
VISUAL  211.292 waypoint Value 4
RETRIEVAL  211.442 Altitude 700
VISUAL  212.407 dial-altitude Value 700
PROCEDURAL  212.457 Confirm Altitude already set to 700
**Goal196    4.857
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL196 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  213.063 SubGoal checking Altitude
VISUAL  214.344 altitude Value 1231
**Goal199    5.069
   isa CHECK-ALTITUDE
   altitude 1231
   previous 1261GOAL199 DIAL DIAL T Ignore-Altitude
PROCEDURAL  215.001 SubGoal checking Autopilot
VISUAL  215.819 otw_runway Value out-of-sight
VISUAL  217.070 autopilots Value up
VISUAL  218.331 altitude Value 1207
**Goal201    8.056
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1207
   decision Engaged
   decision-altitude 600GOAL201 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  219.032 SubGoal checking Altitude
VISUAL  220.056 altitude Value 1197
**Goal205    4.746
   isa CHECK-ALTITUDE
   altitude 1197
   previous 1231GOAL205 DIAL DIAL T Ignore-Altitude
PROCEDURAL  220.712 SubGoal setting Dial Altitude
VISUAL  221.706 waypoint Value 4
RETRIEVAL  221.906 Altitude 700
VISUAL  222.876 dial-altitude Value 700
PROCEDURAL  222.926 Confirm Altitude already set to 700
**Goal207    5.084
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL207 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  223.532 SubGoal checking Altitude
VISUAL  224.436 altitude Value 1171
**Goal210    5.097
   isa CHECK-ALTITUDE
   altitude 1171
   previous 1197GOAL210 DIAL DIAL T Ignore-Altitude
PROCEDURAL  225.092 SubGoal setting Dial Altitude
VISUAL  226.266 waypoint Value 4
RETRIEVAL  226.416 Altitude 700
VISUAL  227.367 dial-altitude Value 700
PROCEDURAL  227.417 Confirm Altitude already set to 700
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**Goal212    4.976
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL212 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  228.025 SubGoal checking Altitude
VISUAL  228.878 altitude Value 1144
**Goal215    4.997
   isa CHECK-ALTITUDE
   altitude 1144
   previous 1171GOAL215 DIAL DIAL T Ignore-Altitude
PROCEDURAL  229.535 SubGoal setting Dial Altitude
VISUAL  230.638 waypoint Value 4
RETRIEVAL  230.788 Altitude 700
VISUAL  231.600 dial-altitude Value 700
PROCEDURAL  231.650 Confirm Altitude already set to 700
**Goal217    5.223
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL217 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  232.258 SubGoal checking Altitude
VISUAL  233.490 altitude Value 1117
**Goal220    4.998
   isa CHECK-ALTITUDE
   altitude 1117
   previous 1144GOAL220 DIAL DIAL T Ignore-Altitude
PROCEDURAL  234.144 SubGoal setting Dial Altitude
VISUAL  235.123 waypoint Value 4
RETRIEVAL  235.273 Altitude 700
VISUAL  236.414 atc Value random-no-listen
VISUAL  236.414 dial-altitude Value 700
PROCEDURAL  236.464 Confirm Altitude already set to 700
**Goal222    5.018
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL222 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  237.070 SubGoal checking Altitude
VISUAL  238.037 altitude Value 1090
**Goal225    5.190
   isa CHECK-ALTITUDE
   altitude 1090
   previous 1117GOAL225 DIAL DIAL T Ignore-Altitude
PROCEDURAL  238.693 SubGoal setting Dial Altitude
VISUAL  239.557 waypoint Value 4
RETRIEVAL  239.707 Altitude 700
VISUAL  240.590 dial-altitude Value 700
PROCEDURAL  240.640 Confirm Altitude already set to 700
**Goal227    4.675
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL227 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  241.246 SubGoal checking Altitude
VISUAL  242.541 altitude Value 1063
**Goal230    4.951
   isa CHECK-ALTITUDE
   altitude 1063
   previous 1090GOAL230 DIAL DIAL T Ignore-Altitude
PROCEDURAL  243.198 SubGoal setting Dial Altitude
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VISUAL  244.267 waypoint Value 4
RETRIEVAL  244.417 Altitude 700
VISUAL  245.376 dial-altitude Value 700
PROCEDURAL  245.426 Confirm Altitude already set to 700
**Goal232    4.991
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL232 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  246.032 SubGoal checking Altitude
VISUAL  247.095 altitude Value 1035
**Goal235    5.111
   isa CHECK-ALTITUDE
   altitude 1035
   previous 1063GOAL235 DIAL DIAL T Ignore-Altitude
PROCEDURAL  247.753 SubGoal setting Dial Altitude
VISUAL  248.882 waypoint Value 4
RETRIEVAL  249.032 Altitude 700
VISUAL  249.974 dial-altitude Value 700
PROCEDURAL  250.024 Confirm Altitude already set to 700
**Goal237    4.977
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL237 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  250.631 SubGoal checking Altitude
VISUAL  251.913 altitude Value 1007
**Goal240    5.145
   isa CHECK-ALTITUDE
   altitude 1007
   previous 1035GOAL240 DIAL DIAL T Ignore-Altitude
PROCEDURAL  252.571 SubGoal setting Dial Altitude
VISUAL  253.652 atc Value late-reassignment
VISUAL  253.652 waypoint Value 5
RETRIEVAL  253.802 Altitude 500
VISUAL  255.024 dial-altitude Value 700
MANUAL  258.098 dial-altitude set 500
**Goal242    4.748
   isa DIAL-ALTITUDE
   waypoint 5
   altitude 500GOAL242 DIAL DIAL T Dial-Altitude
PROCEDURAL  258.704 SubGoal checking Altitude
VISUAL  259.934 altitude Value 908
**Goal246    5.007
   isa CHECK-ALTITUDE
   altitude 908
   previous 1007GOAL246 DIAL DIAL T Ignore-Altitude
PROCEDURAL  260.592 SubGoal setting Dial Altitude
VISUAL  261.753 waypoint Value 5
RETRIEVAL  261.903 Altitude 500
VISUAL  262.975 dial-altitude Value 500
PROCEDURAL  263.025 Confirm Altitude already set to 500
**Goal248    5.166
   isa DIAL-ALTITUDE
   waypoint 5
   altitude 500GOAL248 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  263.631 SubGoal checking Altitude
VISUAL  264.490 altitude Value 846
**Goal251    4.914
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```
    isa CHECK-ALTITUDE
    altitude 846
    previous 908GOAL251 DIAL DIAL T Ignore-Altitude
 PROCEDURAL  265.149 SubGoal checking Autopilot
 VISUAL  266.278 otw_runway Value in-sight
 VISUAL  267.549 autopilots Value up
 PROCEDURAL  267.599 Disengage Autopilot and land
 MANUAL  270.140 autopilots up/down 0
 **Goal253   10.215
    isa SET-AUTOPILOT
    visibility In-Sight
    peek nil
    decision Disengaged
    decision-altitude 600GOAL253 DIAL DIAL T Disengage-Autopilot


*** Finis  ***


*** Setting ModelDone to 1***

 MCP NAV PFD SVS CONTROLS OTW off Total-time
 20.017605 115.88951 79.331505 0 16.812117 19.211897 19.433624
270.69626
EMC End:T 270.69626

Look 1.0 Action 2.5 Listen 0.5 Ans 0.1


;; Factory is idle.
```

3-Baseline VMC Terrain mismatch (traffic on runway)

```
dribbling to file "NASA-hpm-model-results.drb"

; Fast loading
;    C:\Documents and Settings\bbest\My Documents\Completed
Projects\NASA HEM\NasaHEMv07-Jul-
2005\nasav07\HPMv7\delivery\ole\client\autotool.fasl
;   Fast loading
;      C:\Documents and Settings\bbest\My Documents\Completed
Projects\NASA HEM\NasaHEMv07-Jul-
2005\nasav07\HPMv7\delivery\ole\client\idispatch.fasl
;   Fast loading
;      C:\Documents and Settings\bbest\My Documents\Completed
Projects\NASA HEM\NasaHEMv07-Jul-
2005\nasav07\HPMv7\delivery\ole\client\iclassfactory.fasl

Factory Started
CL-USER(1): (register-server)
Resistered Server EMC_NASAHPM.EMCReceiveCOMMessages
NIL
CL-USER(2):
Subject 0 Trial 0 Run 1
Initializing control

 Control    5.050
    isa CONTROL
    speed 200.0d0
    altitude 2500.0d0
    waypoint nil
    distance nil
    flaps 5
    decision-altitude 600
    landing-gear Up
    airbrakes Off
    autopilots Engaged
    task nil
    last-task nil
    status Active
    landing-checklist nil
 VISUAL    0.000 flaps Value 5
 CHUNK NIL IS UNDEFINED.
 CHUNK NIL IS UNDEFINED.
 PROCEDURAL    2.354 Preparing for approach: setting Flaps 1
 MANUAL    2.354 flaps set 1
 PROCEDURAL    5.205 Preparing for approach: engaging Speed-brakes full
 MANUAL    5.205 airbrakes on/off 0
 PROCEDURAL    6.113 Preparing for approach: engaging Autopilot
 VISUAL    6.113 autopilots Value up
 PROCEDURAL    6.962 Preparing for approach: setting LNAV
 VISUAL    6.962 distance-next Value 1
 PROCEDURAL    7.914 Preparing for approach: setting VNAV
 VISUAL    7.914 waypoint Value 1
 PROCEDURAL    8.072 SubGoal checking Flaps
 VISUAL    9.071 speed Value 200
 RETRIEVAL    9.222 Flaps 1
```

```
VISUAL   10.395 flaps Value 1
PROCEDURAL   10.445 Confirm Flaps already set to 1
**Goal6    4.870
   isa SET-FLAP
   speed 200
   flap 1GOAL6 DIAL NIL NIL Flaps-Already-Set
PROCEDURAL   12.053 SubGoal checking Altitude
VISUAL   13.102 altitude Value 2500
**Goal9    5.164
   isa CHECK-ALTITUDE
   altitude 2500
   previous 2500.0d0GOAL9 DIAL NIL NIL Ignore-Altitude
PROCEDURAL   14.759 SubGoal checking Decision Altitude
VISUAL   15.643 waypoint Value 2
VISUAL   16.784 distance-next Value 4
RETRIEVAL   16.884 Waypoint 2 Next 4 Distance 15
**Goal11    4.821
   isa SET-DECISION-ALTITUDE
   waypoint 2
   distance-next 4
   distance 15
   old 600
   decision 600GOAL11 DIAL DIAL T Ignore-Decision-Altitude
PROCEDURAL   17.540 SubGoal checking Speed Brakes
VISUAL   18.452 speed Value 200
VISUAL   19.518 airbrakes Value on
PROCEDURAL   19.568 Setting Speed Brakes
MANUAL   22.004 airbrakes on/off 0
**Goal14    8.744
   isa SPEED-BRAKES
   speed 200
   decision OffGOAL14 DIAL DIAL T Set-Speed-Brakes
PROCEDURAL   22.605 SubGoal setting Dial Altitude
VISUAL   23.409 waypoint Value 2
RETRIEVAL   23.559 Altitude 1800
VISUAL   24.376 dial-altitude Value 2500
MANUAL   26.706 dial-altitude set 1800
**Goal18    5.164
   isa DIAL-ALTITUDE
   waypoint 2
   altitude 1800GOAL18 DIAL DIAL T Dial-Altitude
PROCEDURAL   27.314 SubGoal checking Autopilot
VISUAL   28.383 otw_runway Value out-of-sight
VISUAL   29.184 autopilots Value up
VISUAL   30.103 altitude Value 2500
**Goal22    8.047
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 2500
   decision Engaged
   decision-altitude 600GOAL22 DIAL DIAL T Ignore-Autopilot
PROCEDURAL   30.804 SubGoal checking Landing Gear
VISUAL   31.783 waypoint Value 2
VISUAL   32.761 distance-next Value 3
RETRIEVAL   32.861 Waypoint 2 Next 3 Distance 14
VISUAL   33.679 landing-gear Value up
PROCEDURAL   33.729 Lowering Gear
```

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MANUAL   35.957 landing-gear up/down 0
**Goal26    9.331
   isa MOVE-GEAR
   waypoint 2
   distance-next 3
   distance 14
   decision DownGOAL26 DIAL DIAL T Move-Gear
PROCEDURAL   36.562 SubGoal checking Speed
VISUAL   37.635 waypoint Value 2
VISUAL   38.978 distance-next Value 3
RETRIEVAL   39.079 Waypoint 2 Next 3 Distance 14
RETRIEVAL   39.229 Speed
VISUAL   40.440 dial-speed Value 200
MANUAL   43.482 dial-speed set 160
**Goal31    4.985
   isa SET-SPEED
   waypoint 2
   distance-next 3
   distance 14
   speed 160GOAL31 DIAL DIAL T Dial-Speed
PROCEDURAL   44.089 SubGoal checking Altitude
VISUAL   45.057 altitude Value 2500
**Goal36    4.761
   isa CHECK-ALTITUDE
   altitude 2500
   previous 2500GOAL36 DIAL DIAL T Ignore-Altitude
PROCEDURAL   45.714 SubGoal checking Decision Altitude
VISUAL   46.988 waypoint Value 2
VISUAL   48.100 distance-next Value 2
RETRIEVAL   48.200 Waypoint 2 Next 2 Distance 13
**Goal38    5.351
   isa SET-DECISION-ALTITUDE
   waypoint 2
   distance-next 2
   distance 13
   old 600
   decision 600GOAL38 DIAL DIAL T Ignore-Decision-Altitude
PROCEDURAL   48.857 SubGoal checking Flaps
VISUAL   49.887 speed Value 195
RETRIEVAL   50.087 Flaps 20
VISUAL   51.161 flaps Value 1
MANUAL   53.303 flaps set 20
**Goal41    5.152
   isa SET-FLAP
   speed 195
   flap 20GOAL41 DIAL DIAL T Set-Flaps
PROCEDURAL   53.908 SubGoal checking Speed Brakes
VISUAL   54.992 speed Value 191
VISUAL   56.196 airbrakes Value off
**Goal45    8.303
   isa SPEED-BRAKES
   speed 191
   decision OffGOAL45 DIAL DIAL T Decide-Speed-Brakes
PROCEDURAL   56.796 SubGoal setting Dial Altitude
VISUAL   57.599 waypoint Value 2
RETRIEVAL   57.749 Altitude 1800
VISUAL   58.549 dial-altitude Value 1800
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PROCEDURAL   58.599 Confirm Altitude already set to 1800
**Goal48    4.964
   isa DIAL-ALTITUDE
   waypoint 2
   altitude 1800GOAL48 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL   59.205 SubGoal checking Autopilot
VISUAL   60.131 otw_runway Value out-of-sight
VISUAL   60.996 autopilots Value up
VISUAL   62.044 altitude Value 2500
**Goal51    8.304
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 2500
   decision Engaged
   decision-altitude 600GOAL51 DIAL DIAL T Ignore-Autopilot
PROCEDURAL   62.745 SubGoal checking Landing Gear
VISUAL   63.769 waypoint Value 2
VISUAL   65.083 distance-next Value 1
RETRIEVAL   65.183 Waypoint 2 Next 1 Distance 12
VISUAL   66.479 landing-gear Value down
**Goal55    8.350
   isa MOVE-GEAR
   waypoint 2
   distance-next 1
   distance 12
   decision DownGOAL55 DIAL DIAL T Decide-Gear
PROCEDURAL   67.079 SubGoal checking Speed
VISUAL   68.211 waypoint Value 2
VISUAL   69.476 distance-next Value 1
RETRIEVAL   69.577 Waypoint 2 Next 1 Distance 12
RETRIEVAL   69.677 Speed
VISUAL   70.463 dial-speed Value 160
MANUAL   73.627 dial-speed set 140
**Goal59    5.192
   isa SET-SPEED
   waypoint 2
   distance-next 1
   distance 12
   speed 140GOAL59 DIAL DIAL T Dial-Speed
PROCEDURAL   74.235 SubGoal checking Altitude
VISUAL   75.219 altitude Value 2500
**Goal64    4.935
   isa CHECK-ALTITUDE
   altitude 2500
   previous 2500GOAL64 DIAL DIAL T Ignore-Altitude
PROCEDURAL   75.876 SubGoal checking Decision Altitude
VISUAL   76.890 waypoint Value 2
VISUAL   78.098 distance-next Value 0
RETRIEVAL   78.198 Waypoint 2 Next 0 Distance 11
**Goal66    4.924
   isa SET-DECISION-ALTITUDE
   waypoint 2
   distance-next 0
   distance 11
   old 600
   decision 600GOAL66 DIAL DIAL T Ignore-Decision-Altitude
PROCEDURAL   78.854 SubGoal checking Speed Brakes
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VISUAL   79.838 atc Value random-listen
VISUAL   79.838 speed Value 171
VISUAL   81.121 atc Value ten-miles-out
VISUAL   81.121 airbrakes Value off
**Goal69    8.136
   isa SPEED-BRAKES
   speed 171
   decision OffGOAL69 DIAL DIAL T Decide-Speed-Brakes
PROCEDURAL   81.721 SubGoal setting Dial Altitude
VISUAL   82.631 waypoint Value 3
RETRIEVAL   82.831 Altitude 1000
VISUAL   83.890 dial-altitude Value 1800
MANUAL   86.226 dial-altitude set 1000
**Goal72    4.943
   isa DIAL-ALTITUDE
   waypoint 3
   altitude 1000GOAL72 DIAL DIAL T Dial-Altitude
PROCEDURAL   86.833 SubGoal checking Flaps
VISUAL   87.709 speed Value 165
RETRIEVAL   87.859 Flaps 15
VISUAL   88.935 flaps Value 20
MANUAL   91.633 flaps set 15
**Goal76    4.770
   isa SET-FLAP
   speed 165
   flap 15GOAL76 DIAL DIAL T Set-Flaps
PROCEDURAL   92.240 SubGoal checking Autopilot
VISUAL   93.175 otw_runway Value out-of-sight
VISUAL   94.109 autopilots Value up
VISUAL   94.968 altitude Value 2241
**Goal80    8.571
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 2241
   decision Engaged
   decision-altitude 600GOAL80 DIAL DIAL T Ignore-Autopilot
PROCEDURAL   95.669 SubGoal checking Altitude
VISUAL   96.623 altitude Value 2210
**Goal84    4.550
   isa CHECK-ALTITUDE
   altitude 2210
   previous 2500GOAL84 DIAL DIAL T Read-Altitude
PROCEDURAL   97.280 SubGoal checking Landing Gear
VISUAL   98.546 waypoint Value 3
VISUAL   99.850 distance-next Value 1
RETRIEVAL   99.950 Waypoint 3 Next 1 Distance 10
VISUAL  101.233 landing-gear Value down
**Goal86    8.323
   isa MOVE-GEAR
   waypoint 3
   distance-next 1
   distance 10
   decision DownGOAL86 DIAL DIAL T Decide-Gear
PROCEDURAL  101.833 SubGoal checking Decision Altitude
VISUAL  103.132 waypoint Value 3
VISUAL  104.178 distance-next Value 1
RETRIEVAL  104.278 Waypoint 3 Next 1 Distance 10
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**Goal90    5.065
   isa SET-DECISION-ALTITUDE
   waypoint 3
   distance-next 1
   distance 10
   old 600
   decision 600GOAL90 DIAL DIAL T Ignore-Decision-Altitude
PROCEDURAL  104.936 SubGoal checking Altitude
VISUAL  106.156 altitude Value 2042
**Goal93    5.153
   isa CHECK-ALTITUDE
   altitude 2042
   previous 2210GOAL93 DIAL DIAL T Read-Altitude
PROCEDURAL  106.814 SubGoal checking Speed Brakes
VISUAL  107.963 speed Value 157
VISUAL  108.968 airbrakes Value off
**Goal95    8.203
   isa SPEED-BRAKES
   speed 157
   decision OffGOAL95 DIAL DIAL T Decide-Speed-Brakes
PROCEDURAL  109.568 SubGoal setting Dial Altitude
VISUAL  110.830 waypoint Value 3
RETRIEVAL  110.980 Altitude 1000
VISUAL  111.848 dial-altitude Value 1000
PROCEDURAL  111.898 Confirm Altitude already set to 1000
**Goal98    5.092
   isa DIAL-ALTITUDE
   waypoint 3
   altitude 1000GOAL98 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  112.502 SubGoal checking Autopilot
VISUAL  113.360 otw_runway Value out-of-sight
VISUAL  114.421 autopilots Value up
VISUAL  115.672 altitude Value 1876
**Goal101    8.239
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1876
   decision Engaged
   decision-altitude 600GOAL101 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  116.373 SubGoal checking Speed Brakes
VISUAL  117.178 speed Value 155
VISUAL  118.308 airbrakes Value off
**Goal105    7.687
   isa SPEED-BRAKES
   speed 155
   decision OffGOAL105 DIAL DIAL T Decide-Speed-Brakes
PROCEDURAL  118.908 SubGoal checking Altitude
VISUAL  119.968 altitude Value 1802
**Goal108    4.984
   isa CHECK-ALTITUDE
   altitude 1802
   previous 2042GOAL108 DIAL DIAL T Read-Altitude
PROCEDURAL  120.630 SubGoal setting Dial Altitude
VISUAL  121.584 waypoint Value 4
RETRIEVAL  121.734 Altitude 700
VISUAL  122.917 dial-altitude Value 1000
MANUAL  125.936 dial-altitude set 700
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**Goal110    5.031
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL110 DIAL DIAL T Dial-Altitude
PROCEDURAL  126.539 SubGoal completing landing checklist
PROCEDURAL  129.112 Landing checklist: setting Flaps 15
MANUAL  129.112 flaps set 15
PROCEDURAL  132.002 Landing checklist: preparing cabin for landing
VOCAL  132.002 nothing communication 2007
PROCEDURAL  134.420 Landing checklist: setting Speed to 135
MANUAL  134.420 speed set 135
VISUAL  134.420 speed Value 151
CHUNK NIL IS UNDEFINED.
CHUNK NIL IS UNDEFINED.
PROCEDURAL  136.827 Landing checklist: setting Gear down 1
MANUAL  136.827 landing-gear up/down 0
PROCEDURAL  140.506 Landing checklist: setting Speed-brakes to armed
MANUAL  140.506 airbrakes on/off 0
VOCAL  140.556 Landing Checklist Complete
PROCEDURAL  140.713 SubGoal checking Altitude
VISUAL  141.607 altitude Value 1661
**Goal121    4.755
   isa CHECK-ALTITUDE
   altitude 1661
   previous 1802GOAL121 DIAL DIAL T Ignore-Altitude
PROCEDURAL  142.264 SubGoal checking Autopilot
VISUAL  143.395 otw_runway Value out-of-sight
VISUAL  144.372 autopilots Value up
VISUAL  145.319 altitude Value 1638
**Goal123    8.319
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1638
   decision Engaged
   decision-altitude 600GOAL123 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  146.020 SubGoal checking Altitude
VISUAL  146.883 altitude Value 1628
**Goal127    4.854
   isa CHECK-ALTITUDE
   altitude 1628
   previous 1661GOAL127 DIAL DIAL T Ignore-Altitude
PROCEDURAL  147.543 SubGoal checking Autopilot
VISUAL  148.714 otw_runway Value out-of-sight
VISUAL  149.566 autopilots Value up
VISUAL  150.687 altitude Value 1604
**Goal129    7.883
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1604
   decision Engaged
   decision-altitude 600GOAL129 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  151.388 SubGoal checking Altitude
VISUAL  152.395 altitude Value 1593
**Goal133    4.896
   isa CHECK-ALTITUDE
   altitude 1593
   previous 1628GOAL133 DIAL DIAL T Ignore-Altitude
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PROCEDURAL  153.054 SubGoal setting Dial Altitude
VISUAL  154.122 waypoint Value 4
RETRIEVAL  154.272 Altitude 700
VISUAL  155.444 dial-altitude Value 700
PROCEDURAL  155.494 Confirm Altitude already set to 700
**Goal135    4.838
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL135 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  156.103 SubGoal checking Altitude
VISUAL  157.085 altitude Value 1564
**Goal138    4.980
   isa CHECK-ALTITUDE
   altitude 1564
   previous 1593GOAL138 DIAL DIAL T Ignore-Altitude
PROCEDURAL  157.743 SubGoal checking Autopilot
VISUAL  158.833 atc Value random-listen
VISUAL  158.833 otw_runway Value out-of-sight
VISUAL  160.016 autopilots Value up
VISUAL  160.949 altitude Value 1539
**Goal140    8.039
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1539
   decision Engaged
   decision-altitude 600GOAL140 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  161.650 SubGoal checking Altitude
VISUAL  162.643 altitude Value 1529
**Goal144    4.904
   isa CHECK-ALTITUDE
   altitude 1529
   previous 1564GOAL144 DIAL DIAL T Ignore-Altitude
PROCEDURAL  163.299 SubGoal setting Dial Altitude
VISUAL  164.227 waypoint Value 4
RETRIEVAL  164.377 Altitude 700
VISUAL  165.471 dial-altitude Value 700
PROCEDURAL  165.521 Confirm Altitude already set to 700
**Goal146    4.815
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL146 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  166.129 SubGoal checking Altitude
VISUAL  167.040 altitude Value 1502
**Goal149    5.019
   isa CHECK-ALTITUDE
   altitude 1502
   previous 1529GOAL149 DIAL DIAL T Ignore-Altitude
PROCEDURAL  167.697 SubGoal checking Autopilot
VISUAL  168.667 otw_runway Value out-of-sight
VISUAL  169.647 autopilots Value up
VISUAL  170.556 altitude Value 1480
**Goal151    7.835
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1480
   decision Engaged
   decision-altitude 600GOAL151 DIAL DIAL T Ignore-Autopilot
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PROCEDURAL  171.258 SubGoal checking Altitude
VISUAL  172.113 altitude Value 1471
**Goal155    4.862
   isa CHECK-ALTITUDE
   altitude 1471
   previous 1502GOAL155 DIAL DIAL T Ignore-Altitude
PROCEDURAL  172.770 SubGoal setting Dial Altitude
VISUAL  173.895 waypoint Value 4
RETRIEVAL  174.045 Altitude 700
VISUAL  175.001 dial-altitude Value 700
PROCEDURAL  175.051 Confirm Altitude already set to 700
**Goal157    5.242
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL157 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  175.658 SubGoal checking Altitude
VISUAL  176.544 altitude Value 1443
**Goal160    4.998
   isa CHECK-ALTITUDE
   altitude 1443
   previous 1471GOAL160 DIAL DIAL T Ignore-Altitude
PROCEDURAL  177.201 SubGoal setting Dial Altitude
VISUAL  178.195 waypoint Value 4
RETRIEVAL  178.345 Altitude 700
VISUAL  179.527 dial-altitude Value 700
PROCEDURAL  179.577 Confirm Altitude already set to 700
**Goal162    5.301
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL162 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  180.184 SubGoal checking Altitude
VISUAL  181.130 altitude Value 1416
**Goal165    5.068
   isa CHECK-ALTITUDE
   altitude 1416
   previous 1443GOAL165 DIAL DIAL T Ignore-Altitude
PROCEDURAL  181.786 SubGoal checking Autopilot
VISUAL  182.607 otw_runway Value out-of-sight
VISUAL  183.498 autopilots Value up
VISUAL  184.393 altitude Value 1396
**Goal167    8.175
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1396
   decision Engaged
   decision-altitude 600GOAL167 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  185.094 SubGoal checking Altitude
VISUAL  185.920 altitude Value 1387
**Goal171    4.850
   isa CHECK-ALTITUDE
   altitude 1387
   previous 1416GOAL171 DIAL DIAL T Ignore-Altitude
PROCEDURAL  186.579 SubGoal setting Dial Altitude
VISUAL  187.545 waypoint Value 4
RETRIEVAL  187.695 Altitude 700
VISUAL  188.896 dial-altitude Value 700
PROCEDURAL  188.946 Confirm Altitude already set to 700
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**Goal173    4.833
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL173 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  189.552 SubGoal checking Altitude
VISUAL  190.437 altitude Value 1360
**Goal176    5.255
   isa CHECK-ALTITUDE
   altitude 1360
   previous 1387GOAL176 DIAL DIAL T Ignore-Altitude
PROCEDURAL  191.095 SubGoal setting Dial Altitude
VISUAL  191.994 waypoint Value 4
RETRIEVAL  192.144 Altitude 700
VISUAL  193.081 dial-altitude Value 700
PROCEDURAL  193.131 Confirm Altitude already set to 700
**Goal178    4.909
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL178 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  193.738 SubGoal checking Altitude
VISUAL  194.903 altitude Value 1334
**Goal181    4.910
   isa CHECK-ALTITUDE
   altitude 1334
   previous 1360GOAL181 DIAL DIAL T Ignore-Altitude
PROCEDURAL  195.560 SubGoal setting Dial Altitude
VISUAL  196.728 waypoint Value 4
RETRIEVAL  196.878 Altitude 700
VISUAL  198.024 dial-altitude Value 700
PROCEDURAL  198.074 Confirm Altitude already set to 700
**Goal183    4.908
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL183 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  198.679 SubGoal checking Altitude
VISUAL  199.897 altitude Value 1304
**Goal186    5.272
   isa CHECK-ALTITUDE
   altitude 1304
   previous 1334GOAL186 DIAL DIAL T Ignore-Altitude
PROCEDURAL  200.554 SubGoal checking Autopilot
VISUAL  201.788 otw_runway Value out-of-sight
VISUAL  203.022 autopilots Value up
VISUAL  204.272 altitude Value 1278
**Goal188    8.003
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1278
   decision Engaged
   decision-altitude 600GOAL188 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  204.973 SubGoal checking Altitude
VISUAL  206.010 altitude Value 1267
**Goal192    4.815
   isa CHECK-ALTITUDE
   altitude 1267
   previous 1304GOAL192 DIAL DIAL T Ignore-Altitude
PROCEDURAL  206.667 SubGoal checking Autopilot
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VISUAL  207.573 otw_runway Value out-of-sight
VISUAL  208.626 autopilots Value up
VISUAL  209.673 altitude Value 1245
**Goal194    7.991
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1245
   decision Engaged
   decision-altitude 600GOAL194 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  210.375 SubGoal checking Altitude
VISUAL  211.667 altitude Value 1233
**Goal198    4.939
   isa CHECK-ALTITUDE
   altitude 1233
   previous 1267GOAL198 DIAL DIAL T Ignore-Altitude
PROCEDURAL  212.323 SubGoal setting Dial Altitude
VISUAL  213.128 waypoint Value 4
RETRIEVAL  213.278 Altitude 700
VISUAL  214.112 dial-altitude Value 700
PROCEDURAL  214.162 Confirm Altitude already set to 700
**Goal200    5.079
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL200 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  214.768 SubGoal checking Altitude
VISUAL  215.999 altitude Value 1208
**Goal203    4.694
   isa CHECK-ALTITUDE
   altitude 1208
   previous 1233GOAL203 DIAL DIAL T Ignore-Altitude
PROCEDURAL  216.657 SubGoal setting Dial Altitude
VISUAL  217.890 waypoint Value 4
RETRIEVAL  218.040 Altitude 700
VISUAL  219.138 dial-altitude Value 700
PROCEDURAL  219.188 Confirm Altitude already set to 700
**Goal205    5.235
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL205 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  219.794 SubGoal checking Altitude
VISUAL  220.713 altitude Value 1180
**Goal208    5.129
   isa CHECK-ALTITUDE
   altitude 1180
   previous 1208GOAL208 DIAL DIAL T Ignore-Altitude
PROCEDURAL  221.370 SubGoal setting Dial Altitude
VISUAL  222.377 waypoint Value 4
RETRIEVAL  222.527 Altitude 700
VISUAL  223.497 dial-altitude Value 700
PROCEDURAL  223.547 Confirm Altitude already set to 700
**Goal210    4.947
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL210 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  224.152 SubGoal checking Altitude
VISUAL  225.265 altitude Value 1152
**Goal213    5.085
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   isa CHECK-ALTITUDE
   altitude 1152
   previous 1180GOAL213 DIAL DIAL T Ignore-Altitude
PROCEDURAL  225.921 SubGoal checking Autopilot
VISUAL  227.158 otw_runway Value out-of-sight
VISUAL  228.248 autopilots Value up
VISUAL  229.302 altitude Value 1128
**Goal215    7.825
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1128
   decision Engaged
   decision-altitude 600GOAL215 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  230.004 SubGoal checking Altitude
VISUAL  231.095 altitude Value 1118
**Goal219    5.006
   isa CHECK-ALTITUDE
   altitude 1118
   previous 1152GOAL219 DIAL DIAL T Ignore-Altitude
PROCEDURAL  231.753 SubGoal setting Dial Altitude
VISUAL  232.672 waypoint Value 4
RETRIEVAL  232.822 Altitude 700
VISUAL  233.721 dial-altitude Value 700
PROCEDURAL  233.771 Confirm Altitude already set to 700
**Goal221    5.111
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL221 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  234.378 SubGoal checking Altitude
VISUAL  235.425 altitude Value 1092
**Goal224    4.922
   isa CHECK-ALTITUDE
   altitude 1092
   previous 1118GOAL224 DIAL DIAL T Ignore-Altitude
PROCEDURAL  236.081 SubGoal setting Dial Altitude
VISUAL  237.360 waypoint Value 4
RETRIEVAL  237.510 Altitude 700
VISUAL  238.263 dial-altitude Value 700
PROCEDURAL  238.313 Confirm Altitude already set to 700
**Goal226    5.321
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL226 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  238.920 SubGoal checking Altitude
VISUAL  239.949 atc Value random-listen
VISUAL  239.949 altitude Value 1064
**Goal229    5.295
   isa CHECK-ALTITUDE
   altitude 1064
   previous 1092GOAL229 DIAL DIAL T Ignore-Altitude
PROCEDURAL  240.605 SubGoal setting Dial Altitude
VISUAL  241.548 waypoint Value 4
RETRIEVAL  241.698 Altitude 700
VISUAL  242.812 dial-altitude Value 700
PROCEDURAL  242.862 Confirm Altitude already set to 700
**Goal231    5.020
   isa DIAL-ALTITUDE
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   waypoint 4
   altitude 700GOAL231 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  243.470 SubGoal checking Altitude
VISUAL  244.674 altitude Value 1036
**Goal234    4.924
   isa CHECK-ALTITUDE
   altitude 1036
   previous 1064GOAL234 DIAL DIAL T Ignore-Altitude
PROCEDURAL  245.331 SubGoal checking Autopilot
VISUAL  246.451 otw_runway Value out-of-sight
VISUAL  247.308 autopilots Value up
VISUAL  248.219 altitude Value 1015
**Goal236    7.897
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1015
   decision Engaged
   decision-altitude 600GOAL236 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  248.921 SubGoal checking Altitude
VISUAL  249.995 altitude Value 1005
**Goal240    4.906
   isa CHECK-ALTITUDE
   altitude 1005
   previous 1036GOAL240 DIAL DIAL T Ignore-Altitude
PROCEDURAL  250.652 SubGoal checking Autopilot
VISUAL  251.497 otw_runway Value out-of-sight
VISUAL  252.456 autopilots Value up
VISUAL  253.613 altitude Value 962
**Goal242    7.849
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 962
   decision Engaged
   decision-altitude 600GOAL242 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  254.315 SubGoal checking Altitude
VISUAL  255.493 altitude Value 936
**Goal246    4.924
   isa CHECK-ALTITUDE
   altitude 936
   previous 1005GOAL246 DIAL DIAL T Ignore-Altitude
PROCEDURAL  256.150 SubGoal setting Dial Altitude
VISUAL  257.356 waypoint Value 5
RETRIEVAL  257.506 Altitude 500
VISUAL  258.350 dial-altitude Value 700
MANUAL  260.735 dial-altitude set 500
**Goal248    4.784
   isa DIAL-ALTITUDE
   waypoint 5
   altitude 500GOAL248 DIAL DIAL T Dial-Altitude
PROCEDURAL  261.340 SubGoal checking Altitude
VISUAL  262.358 altitude Value 844
**Goal252    5.067
   isa CHECK-ALTITUDE
   altitude 844
   previous 936GOAL252 DIAL DIAL T Ignore-Altitude
PROCEDURAL  263.015 SubGoal setting Dial Altitude
VISUAL  264.090 waypoint Value 5
```

```
RETRIEVAL  264.241 Altitude 500
VISUAL  265.232 dial-altitude Value 500
PROCEDURAL  265.282 Confirm Altitude already set to 500
**Goal254    5.156
   isa DIAL-ALTITUDE
   waypoint 5
   altitude 500GOAL254 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  265.888 SubGoal checking Altitude
VISUAL  266.835 altitude Value 785
**Goal257    5.231
   isa CHECK-ALTITUDE
   altitude 785
   previous 844GOAL257 DIAL DIAL T Ignore-Altitude
PROCEDURAL  267.493 SubGoal checking Autopilot
VISUAL  268.573 otw_runway Value out-of-sight
VISUAL  269.427 autopilots Value up
VISUAL  270.326 altitude Value 738
**Goal259    7.912
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 738
   decision Engaged
   decision-altitude 600GOAL259 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  271.027 SubGoal checking Altitude
VISUAL  272.070 altitude Value 714
**Goal263    4.545
   isa CHECK-ALTITUDE
   altitude 714
   previous 785GOAL263 DIAL DIAL T Ignore-Altitude
PROCEDURAL  272.726 SubGoal checking Autopilot
VISUAL  273.851 otw_runway Value out-of-sight
VISUAL  274.764 autopilots Value up
VISUAL  275.596 altitude Value 641
**Goal265    7.705
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 641
   decision Engaged
   decision-altitude 600GOAL265 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  276.298 SubGoal checking Altitude
VISUAL  277.407 altitude Value 607
**Goal269    4.983
   isa CHECK-ALTITUDE
   altitude 607
   previous 714GOAL269 DIAL DIAL T Ignore-Altitude
PROCEDURAL  278.065 SubGoal checking Autopilot
VISUAL  279.144 otw_runway Value runway-traffic
VISUAL  279.975 autopilots Value up
PROCEDURAL  280.025 Traffic on runway -- going around
MANUAL  283.133 autopilots up/down 0
VISUAL  284.038 altitude Value 550
**Goal271    9.904
   isa SET-AUTOPILOT
   visibility Runway-Traffic
   peek Looking
   decision Disengaged
   decision-altitude 600GOAL271 DIAL DIAL T Peek
```

```
*** Finis  ***


*** Setting ModelDone to 1***

 MCP NAV PFD SVS CONTROLS OTW off Total-time
 30.218935 103.30941 86.09211 0 16.281054 18.190874 30.495605 284.58798
EMC End:T 284.58798

Look 1.0 Action 2.5 Listen 0.5 Ans 0.1


;; Factory is idle.
```

4-Baseline IMC Nominal landing (land on parallel runway)

```
dribbling to file "NASA-hpm-model-results.drb"

; Fast loading
;    C:\Documents and Settings\bbest\My Documents\Completed
Projects\NASA HEM\NasaHEMv07-Jul-
2005\nasav07\HPMv7\delivery\ole\client\autotool.fasl
;   Fast loading
;      C:\Documents and Settings\bbest\My Documents\Completed
Projects\NASA HEM\NasaHEMv07-Jul-
2005\nasav07\HPMv7\delivery\ole\client\idispatch.fasl
;   Fast loading
;      C:\Documents and Settings\bbest\My Documents\Completed
Projects\NASA HEM\NasaHEMv07-Jul-
2005\nasav07\HPMv7\delivery\ole\client\iclassfactory.fasl

Factory Started
CL-USER(1): (register-server)
Resistered Server EMC_NASAHPM.EMCReceiveCOMMessages
NIL
CL-USER(2):
Subject 0 Trial 0 Run 1
Initializing control

 Control    4.817
    isa CONTROL
    speed 200.0d0
    altitude 2500.0d0
    waypoint nil
    distance nil
    flaps 5
    decision-altitude 600
    landing-gear Up
    airbrakes Off
    autopilots Engaged
    task nil
    last-task nil
    status Active
    landing-checklist nil
 VISUAL    0.000 flaps Value 5
 CHUNK NIL IS UNDEFINED.
 CHUNK NIL IS UNDEFINED.
 PROCEDURAL    0.937 Preparing for approach: engaging Autopilot
 VISUAL    0.937 autopilots Value up
 PROCEDURAL    2.885 Preparing for approach: setting Flaps 1
 MANUAL    2.885 flaps set 1
 PROCEDURAL    3.794 Preparing for approach: setting LNAV
 VISUAL    3.794 distance-next Value 1
 PROCEDURAL    7.475 Preparing for approach: engaging Speed-brakes full
 MANUAL    7.475 airbrakes on/off 0
 PROCEDURAL    8.594 Preparing for approach: setting VNAV
 VISUAL    8.594 waypoint Value 1
 PROCEDURAL    8.751 SubGoal checking Altitude
 VISUAL    9.856 altitude Value 2500
 **Goal6    4.763
```

```
   isa CHECK-ALTITUDE
   altitude 2500
   previous 2500.0d0GOAL6 NIL NIL T Ignore-Altitude
PROCEDURAL   10.512 SubGoal checking Autopilot
VISUAL   11.809 otw_runway Value out-of-sight
VISUAL   12.858 autopilots Value up
VISUAL   13.786 altitude Value 2500
**Goal8    8.422
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 2500
   decision Engaged
   decision-altitude 600GOAL8 NIL NIL T Ignore-Autopilot
PROCEDURAL   14.487 SubGoal setting Dial Altitude
VISUAL   15.349 waypoint Value 1
RETRIEVAL   15.549 Altitude 2500
VISUAL   16.623 dial-altitude Value 2500
PROCEDURAL   16.673 Confirm Altitude already set to 2500
**Goal12    4.862
   isa DIAL-ALTITUDE
   waypoint 1
   altitude 2500GOAL12 DIAL NIL NIL Dial-Altitude-Already-Dialed
PROCEDURAL   18.279 SubGoal checking Decision Altitude
VISUAL   19.275 waypoint Value 2
VISUAL   20.525 distance-next Value 4
RETRIEVAL   20.625 Waypoint 2 Next 4 Distance 15
**Goal15    5.119
   isa SET-DECISION-ALTITUDE
   waypoint 2
   distance-next 4
   distance 15
   old 600
   decision 600GOAL15 DIAL DIAL T Ignore-Decision-Altitude
PROCEDURAL   21.281 SubGoal checking Landing Gear
VISUAL   22.176 waypoint Value 2
VISUAL   23.143 distance-next Value 4
RETRIEVAL   23.243 Waypoint 2 Next 4 Distance 15
VISUAL   24.308 landing-gear Value up
PROCEDURAL   24.358 Lowering Gear
MANUAL   26.324 landing-gear up/down 0
**Goal18    8.931
   isa MOVE-GEAR
   waypoint 2
   distance-next 4
   distance 15
   decision DownGOAL18 DIAL DIAL T Move-Gear
PROCEDURAL   26.931 SubGoal checking Speed
VISUAL   27.969 waypoint Value 2
VISUAL   29.080 distance-next Value 3
RETRIEVAL   29.180 Waypoint 2 Next 3 Distance 14
RETRIEVAL   29.330 Speed
VISUAL   30.565 dial-speed Value 200
MANUAL   33.436 dial-speed set 165
**Goal23    4.981
   isa SET-SPEED
   waypoint 2
   distance-next 3
```

```
   distance 14
   speed 165GOAL23 DIAL DIAL T Dial-Speed
PROCEDURAL   34.045 SubGoal checking Flaps
VISUAL   35.206 speed Value 199
RETRIEVAL   35.406 Flaps 15
VISUAL   36.594 flaps Value 1
MANUAL   39.607 flaps set 15
**Goal28    5.196
   isa SET-FLAP
   speed 199
   flap 15GOAL28 DIAL DIAL T Set-Flaps
PROCEDURAL   40.215 SubGoal checking Speed Brakes
VISUAL   41.111 speed Value 194
VISUAL   42.130 airbrakes Value on
PROCEDURAL   42.180 Setting Speed Brakes
MANUAL   44.421 airbrakes on/off 0
**Goal32    8.776
   isa SPEED-BRAKES
   speed 194
   decision OffGOAL32 DIAL DIAL T Set-Speed-Brakes
PROCEDURAL   45.021 SubGoal checking Altitude
VISUAL   45.845 altitude Value 2500
**Goal36    4.990
   isa CHECK-ALTITUDE
   altitude 2500
   previous 2500GOAL36 DIAL DIAL T Ignore-Altitude
PROCEDURAL   46.503 SubGoal checking Decision Altitude
VISUAL   47.327 waypoint Value 2
VISUAL   48.245 distance-next Value 2
RETRIEVAL   48.345 Waypoint 2 Next 2 Distance 13
**Goal38    4.989
   isa SET-DECISION-ALTITUDE
   waypoint 2
   distance-next 2
   distance 13
   old 600
   decision 600GOAL38 DIAL DIAL T Ignore-Decision-Altitude
PROCEDURAL   49.001 SubGoal checking Autopilot
VISUAL   50.042 otw_runway Value out-of-sight
VISUAL   50.923 autopilots Value up
VISUAL   51.996 altitude Value 2500
**Goal41    8.483
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 2500
   decision Engaged
   decision-altitude 600GOAL41 DIAL DIAL T Ignore-Autopilot
PROCEDURAL   52.697 SubGoal setting Dial Altitude
VISUAL   53.709 waypoint Value 2
RETRIEVAL   53.859 Altitude 1800
VISUAL   55.099 dial-altitude Value 2500
MANUAL   57.748 dial-altitude set 1800
**Goal45    5.065
   isa DIAL-ALTITUDE
   waypoint 2
   altitude 1800GOAL45 DIAL DIAL T Dial-Altitude
PROCEDURAL   58.355 SubGoal checking Landing Gear
```

```
VISUAL   59.366 waypoint Value 2
VISUAL   60.481 distance-next Value 1
RETRIEVAL   60.581 Waypoint 2 Next 1 Distance 12
VISUAL   61.535 landing-gear Value down
**Goal49    8.563
   isa MOVE-GEAR
   waypoint 2
   distance-next 1
   distance 12
   decision DownGOAL49 DIAL DIAL T Decide-Gear
PROCEDURAL   62.135 SubGoal checking Flaps
VISUAL   63.178 speed Value 176
RETRIEVAL   63.329 Flaps 25
VISUAL   64.454 flaps Value 15
MANUAL   67.021 flaps set 25
**Goal53    4.961
   isa SET-FLAP
   speed 176
   flap 25GOAL53 DIAL DIAL T Set-Flaps
PROCEDURAL   67.628 SubGoal checking Altitude
VISUAL   68.818 altitude Value 2500
**Goal57    4.806
   isa CHECK-ALTITUDE
   altitude 2500
   previous 2500GOAL57 DIAL DIAL T Ignore-Altitude
PROCEDURAL   69.476 SubGoal checking Speed Brakes
VISUAL   70.594 speed Value 170
VISUAL   71.575 airbrakes Value off
**Goal59    8.689
   isa SPEED-BRAKES
   speed 170
   decision OffGOAL59 DIAL DIAL T Decide-Speed-Brakes
PROCEDURAL   72.175 SubGoal checking Speed
VISUAL   73.169 waypoint Value 2
VISUAL   74.265 distance-next Value 0
RETRIEVAL   74.365 Waypoint 2 Next 0 Distance 11
RETRIEVAL   74.465 Speed
VISUAL   75.399 dial-speed Value 165
MANUAL   77.470 dial-speed set 140
**Goal62    5.166
   isa SET-SPEED
   waypoint 2
   distance-next 0
   distance 11
   speed 140GOAL62 DIAL DIAL T Dial-Speed
PROCEDURAL   78.077 SubGoal checking Decision Altitude
VISUAL   79.284 waypoint Value 2
VISUAL   80.565 atc Value random-listen
VISUAL   80.565 distance-next Value 0
RETRIEVAL   80.665 Waypoint 2 Next 0 Distance 11
**Goal67    4.580
   isa SET-DECISION-ALTITUDE
   waypoint 2
   distance-next 0
   distance 11
   old 600
   decision 600GOAL67 DIAL DIAL T Ignore-Decision-Altitude
```

```
PROCEDURAL   81.321 SubGoal checking Autopilot
VISUAL   82.191 otw_runway Value out-of-sight
VISUAL   83.302 atc Value ten-miles-out
VISUAL   83.302 autopilots Value up
VISUAL   84.280 altitude Value 2477
**Goal70    8.925
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 2477
   decision Engaged
   decision-altitude 600GOAL70 DIAL DIAL T Ignore-Autopilot
PROCEDURAL   84.980 SubGoal checking Speed Brakes
VISUAL   85.952 speed Value 159
VISUAL   87.272 airbrakes Value off
**Goal74    8.590
   isa SPEED-BRAKES
   speed 159
   decision OffGOAL74 DIAL DIAL T Decide-Speed-Brakes
PROCEDURAL   87.872 SubGoal setting Dial Altitude
VISUAL   89.008 waypoint Value 3
RETRIEVAL   89.158 Altitude 1000
VISUAL   90.099 dial-altitude Value 1800
MANUAL   92.152 dial-altitude set 1000
**Goal77    5.174
   isa DIAL-ALTITUDE
   waypoint 3
   altitude 1000GOAL77 DIAL DIAL T Dial-Altitude
PROCEDURAL   92.758 SubGoal checking Altitude
VISUAL   93.970 altitude Value 2305
**Goal81    5.066
   isa CHECK-ALTITUDE
   altitude 2305
   previous 2500GOAL81 DIAL DIAL T Read-Altitude
PROCEDURAL   94.626 SubGoal checking Landing Gear
VISUAL   95.429 waypoint Value 3
VISUAL   96.775 distance-next Value 1
RETRIEVAL   96.875 Waypoint 3 Next 1 Distance 10
VISUAL   97.854 landing-gear Value down
**Goal83    8.559
   isa MOVE-GEAR
   waypoint 3
   distance-next 1
   distance 10
   decision DownGOAL83 DIAL DIAL T Decide-Gear
PROCEDURAL   98.454 SubGoal checking Decision Altitude
VISUAL   99.427 waypoint Value 3
VISUAL  100.559 distance-next Value 1
RETRIEVAL  100.659 Waypoint 3 Next 1 Distance 10
**Goal87    4.876
   isa SET-DECISION-ALTITUDE
   waypoint 3
   distance-next 1
   distance 10
   old 600
   decision 600GOAL87 DIAL DIAL T Ignore-Decision-Altitude
PROCEDURAL  101.315 SubGoal checking Flaps
VISUAL  102.496 speed Value 156
```

```
RETRIEVAL  102.646 Flaps 20
VISUAL  103.841 flaps Value 25
MANUAL  106.658 flaps set 20
**Goal90    4.789
   isa SET-FLAP
   speed 156
   flap 20GOAL90 DIAL DIAL T Set-Flaps
PROCEDURAL  107.263 SubGoal checking Speed Brakes
VISUAL  108.242 speed Value 155
VISUAL  109.290 airbrakes Value off
**Goal94    8.079
   isa SPEED-BRAKES
   speed 155
   decision OffGOAL94 DIAL DIAL T Decide-Speed-Brakes
PROCEDURAL  109.890 SubGoal checking Altitude
VISUAL  110.953 altitude Value 2008
**Goal97    4.854
   isa CHECK-ALTITUDE
   altitude 2008
   previous 2305GOAL97 DIAL DIAL T Read-Altitude
PROCEDURAL  111.610 SubGoal checking Autopilot
VISUAL  112.522 otw_runway Value out-of-sight
VISUAL  113.715 autopilots Value up
VISUAL  114.764 altitude Value 1943
**Goal99    8.131
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1943
   decision Engaged
   decision-altitude 600GOAL99 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  115.465 SubGoal checking Decision Altitude
VISUAL  116.278 waypoint Value 3
VISUAL  117.200 distance-next Value 0
RETRIEVAL  117.300 Waypoint 3 Next 0 Distance 9
**Goal103    5.029
   isa SET-DECISION-ALTITUDE
   waypoint 3
   distance-next 0
   distance 9
   old 600
   decision 600GOAL103 DIAL DIAL T Ignore-Decision-Altitude
PROCEDURAL  117.957 SubGoal checking Speed
VISUAL  119.162 waypoint Value 3
VISUAL  120.118 distance-next Value 0
RETRIEVAL  120.218 Waypoint 3 Next 0 Distance 9
RETRIEVAL  120.319 Speed
VISUAL  121.107 dial-speed Value 140
PROCEDURAL  121.157 Confirm Speed already set to 140
**Goal106    4.793
   isa SET-SPEED
   waypoint 3
   distance-next 0
   distance 9
   speed 140GOAL106 DIAL DIAL T Speed-Already-Dialed
PROCEDURAL  121.764 SubGoal checking Altitude
VISUAL  122.870 altitude Value 1805
**Goal110    4.899
```

```
   isa CHECK-ALTITUDE
   altitude 1805
   previous 2008GOAL110 DIAL DIAL T Read-Altitude
PROCEDURAL  123.526 SubGoal setting Dial Altitude
VISUAL  124.747 waypoint Value 4
RETRIEVAL  124.897 Altitude 700
VISUAL  125.726 dial-altitude Value 1000
MANUAL  128.003 dial-altitude set 700
**Goal112    5.111
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL112 DIAL DIAL T Dial-Altitude
PROCEDURAL  128.609 SubGoal completing landing checklist
PROCEDURAL  131.424 Landing checklist: preparing cabin for landing
VOCAL  131.424 nothing communication 2007
PROCEDURAL  133.375 Landing checklist: setting Gear down 1
MANUAL  133.375 landing-gear up/down 0
PROCEDURAL  136.456 Landing checklist: setting Speed to 135
MANUAL  136.456 speed set 135
VISUAL  136.456 speed Value 148
CHUNK NIL IS UNDEFINED.
CHUNK NIL IS UNDEFINED.
PROCEDURAL  140.054 Landing checklist: setting Speed-brakes to armed
MANUAL  140.054 airbrakes on/off 0
PROCEDURAL  142.550 Landing checklist: setting Flaps 15
MANUAL  142.550 flaps set 15
VOCAL  142.600 Landing Checklist Complete
PROCEDURAL  142.758 SubGoal checking Autopilot
VISUAL  143.783 otw_runway Value out-of-sight
VISUAL  144.754 autopilots Value up
VISUAL  145.891 altitude Value 1656
**Goal123    8.501
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1656
   decision Engaged
   decision-altitude 600GOAL123 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  146.592 SubGoal checking Altitude
VISUAL  147.644 altitude Value 1645
**Goal127    5.171
   isa CHECK-ALTITUDE
   altitude 1645
   previous 1805GOAL127 DIAL DIAL T Read-Altitude
PROCEDURAL  148.299 SubGoal setting Dial Altitude
VISUAL  149.199 waypoint Value 4
RETRIEVAL  149.349 Altitude 700
VISUAL  150.255 dial-altitude Value 700
PROCEDURAL  150.305 Confirm Altitude already set to 700
**Goal129    4.938
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL129 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  150.912 SubGoal checking Altitude
VISUAL  151.813 altitude Value 1619
**Goal132    4.845
   isa CHECK-ALTITUDE
   altitude 1619
```

```
   previous 1645GOAL132 DIAL DIAL T Ignore-Altitude
PROCEDURAL  152.470 SubGoal checking Autopilot
VISUAL  153.458 otw_runway Value out-of-sight
VISUAL  154.301 autopilots Value up
VISUAL  155.579 altitude Value 1596
**Goal134    8.105
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1596
   decision Engaged
   decision-altitude 600GOAL134 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  156.279 SubGoal checking Altitude
VISUAL  157.202 altitude Value 1586
**Goal138    4.784
   isa CHECK-ALTITUDE
   altitude 1586
   previous 1619GOAL138 DIAL DIAL T Ignore-Altitude
PROCEDURAL  157.860 SubGoal setting Dial Altitude
VISUAL  158.722 atc Value random-listen
VISUAL  158.722 waypoint Value 4
RETRIEVAL  158.872 Altitude 700
VISUAL  159.786 dial-altitude Value 700
PROCEDURAL  159.836 Confirm Altitude already set to 700
**Goal140    5.274
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL140 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  160.443 SubGoal checking Altitude
VISUAL  161.710 altitude Value 1558
**Goal143    5.006
   isa CHECK-ALTITUDE
   altitude 1558
   previous 1586GOAL143 DIAL DIAL T Ignore-Altitude
PROCEDURAL  162.367 SubGoal setting Dial Altitude
VISUAL  163.226 waypoint Value 4
RETRIEVAL  163.376 Altitude 700
VISUAL  164.241 dial-altitude Value 700
PROCEDURAL  164.291 Confirm Altitude already set to 700
**Goal145    5.066
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL145 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  164.899 SubGoal checking Altitude
VISUAL  165.823 altitude Value 1533
**Goal148    4.958
   isa CHECK-ALTITUDE
   altitude 1533
   previous 1558GOAL148 DIAL DIAL T Ignore-Altitude
PROCEDURAL  166.482 SubGoal setting Dial Altitude
VISUAL  167.488 waypoint Value 4
RETRIEVAL  167.639 Altitude 700
VISUAL  168.463 dial-altitude Value 700
PROCEDURAL  168.513 Confirm Altitude already set to 700
**Goal150    4.956
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL150 DIAL DIAL T Dial-Altitude-Already-Dialed
```

```
PROCEDURAL  169.119 SubGoal checking Altitude
VISUAL  169.928 altitude Value 1509
**Goal153    4.978
   isa CHECK-ALTITUDE
   altitude 1509
   previous 1533GOAL153 DIAL DIAL T Ignore-Altitude
PROCEDURAL  170.587 SubGoal checking Autopilot
VISUAL  171.563 otw_runway Value out-of-sight
VISUAL  172.826 autopilots Value up
VISUAL  173.723 altitude Value 1486
**Goal155    7.745
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1486
   decision Engaged
   decision-altitude 600GOAL155 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  174.425 SubGoal checking Altitude
VISUAL  175.602 altitude Value 1474
**Goal159    5.016
   isa CHECK-ALTITUDE
   altitude 1474
   previous 1509GOAL159 DIAL DIAL T Ignore-Altitude
PROCEDURAL  176.258 SubGoal checking Autopilot
VISUAL  177.437 otw_runway Value out-of-sight
VISUAL  178.667 autopilots Value up
VISUAL  179.749 altitude Value 1449
**Goal161    7.992
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1449
   decision Engaged
   decision-altitude 600GOAL161 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  180.450 SubGoal checking Altitude
VISUAL  181.617 altitude Value 1438
**Goal165    4.687
   isa CHECK-ALTITUDE
   altitude 1438
   previous 1474GOAL165 DIAL DIAL T Ignore-Altitude
PROCEDURAL  182.274 SubGoal setting Dial Altitude
VISUAL  183.424 waypoint Value 4
RETRIEVAL  183.574 Altitude 700
VISUAL  184.748 dial-altitude Value 700
PROCEDURAL  184.798 Confirm Altitude already set to 700
**Goal167    4.819
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL167 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  185.406 SubGoal checking Altitude
VISUAL  186.685 altitude Value 1408
**Goal170    5.295
   isa CHECK-ALTITUDE
   altitude 1408
   previous 1438GOAL170 DIAL DIAL T Ignore-Altitude
PROCEDURAL  187.341 SubGoal checking Autopilot
VISUAL  188.259 otw_runway Value out-of-sight
VISUAL  189.123 autopilots Value up
VISUAL  190.006 altitude Value 1388
```

```
**Goal172    8.056
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1388
   decision Engaged
   decision-altitude 600GOAL172 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  190.707 SubGoal checking Altitude
VISUAL  191.811 altitude Value 1377
**Goal176    5.009
   isa CHECK-ALTITUDE
   altitude 1377
   previous 1408GOAL176 DIAL DIAL T Ignore-Altitude
PROCEDURAL  192.469 SubGoal setting Dial Altitude
VISUAL  193.570 waypoint Value 4
RETRIEVAL  193.720 Altitude 700
VISUAL  194.499 dial-altitude Value 700
PROCEDURAL  194.549 Confirm Altitude already set to 700
**Goal178    4.836
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL178 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  195.158 SubGoal checking Altitude
VISUAL  196.440 altitude Value 1349
**Goal181    4.578
   isa CHECK-ALTITUDE
   altitude 1349
   previous 1377GOAL181 DIAL DIAL T Ignore-Altitude
PROCEDURAL  197.096 SubGoal setting Dial Altitude
VISUAL  198.384 waypoint Value 4
RETRIEVAL  198.534 Altitude 700
VISUAL  199.535 dial-altitude Value 700
PROCEDURAL  199.585 Confirm Altitude already set to 700
**Goal183    5.202
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL183 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  200.193 SubGoal checking Altitude
VISUAL  201.384 altitude Value 1320
**Goal186    4.944
   isa CHECK-ALTITUDE
   altitude 1320
   previous 1349GOAL186 DIAL DIAL T Ignore-Altitude
PROCEDURAL  202.041 SubGoal setting Dial Altitude
VISUAL  203.244 waypoint Value 4
RETRIEVAL  203.394 Altitude 700
VISUAL  204.264 dial-altitude Value 700
PROCEDURAL  204.314 Confirm Altitude already set to 700
**Goal188    4.911
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL188 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  204.922 SubGoal checking Altitude
VISUAL  206.201 altitude Value 1292
**Goal191    5.079
   isa CHECK-ALTITUDE
   altitude 1292
   previous 1320GOAL191 DIAL DIAL T Ignore-Altitude
```

```
PROCEDURAL  206.857 SubGoal setting Dial Altitude
VISUAL  208.121 waypoint Value 4
RETRIEVAL  208.271 Altitude 700
VISUAL  209.292 dial-altitude Value 700
PROCEDURAL  209.342 Confirm Altitude already set to 700
**Goal193    4.963
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL193 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  209.949 SubGoal checking Altitude
VISUAL  211.217 altitude Value 1262
**Goal196    5.281
   isa CHECK-ALTITUDE
   altitude 1262
   previous 1292GOAL196 DIAL DIAL T Ignore-Altitude
PROCEDURAL  211.875 SubGoal setting Dial Altitude
VISUAL  213.162 waypoint Value 4
RETRIEVAL  213.312 Altitude 700
VISUAL  214.309 dial-altitude Value 700
PROCEDURAL  214.359 Confirm Altitude already set to 700
**Goal198    4.711
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL198 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  214.965 SubGoal checking Altitude
VISUAL  215.967 altitude Value 1233
**Goal201    4.938
   isa CHECK-ALTITUDE
   altitude 1233
   previous 1262GOAL201 DIAL DIAL T Ignore-Altitude
PROCEDURAL  216.624 SubGoal setting Dial Altitude
VISUAL  217.888 waypoint Value 4
RETRIEVAL  218.038 Altitude 700
VISUAL  219.260 dial-altitude Value 700
PROCEDURAL  219.310 Confirm Altitude already set to 700
**Goal203    4.932
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL203 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  219.917 SubGoal checking Altitude
VISUAL  221.012 altitude Value 1203
**Goal206    4.894
   isa CHECK-ALTITUDE
   altitude 1203
   previous 1233GOAL206 DIAL DIAL T Ignore-Altitude
PROCEDURAL  221.668 SubGoal checking Autopilot
VISUAL  222.768 otw_runway Value out-of-sight
VISUAL  223.882 autopilots Value up
VISUAL  224.759 altitude Value 1181
**Goal208    8.026
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1181
   decision Engaged
   decision-altitude 600GOAL208 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  225.460 SubGoal checking Altitude
VISUAL  226.461 altitude Value 1170
```

```
**Goal212    4.398
   isa CHECK-ALTITUDE
   altitude 1170
   previous 1203GOAL212 DIAL DIAL T Ignore-Altitude
PROCEDURAL  227.117 SubGoal checking Autopilot
VISUAL  227.994 otw_runway Value out-of-sight
VISUAL  229.149 autopilots Value up
VISUAL  230.227 altitude Value 1148
**Goal214    7.993
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1148
   decision Engaged
   decision-altitude 600GOAL214 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  230.929 SubGoal checking Altitude
VISUAL  231.828 altitude Value 1139
**Goal218    4.868
   isa CHECK-ALTITUDE
   altitude 1139
   previous 1170GOAL218 DIAL DIAL T Ignore-Altitude
PROCEDURAL  232.483 SubGoal setting Dial Altitude
VISUAL  233.774 waypoint Value 4
RETRIEVAL  233.974 Altitude 700
VISUAL  235.112 dial-altitude Value 700
PROCEDURAL  235.162 Confirm Altitude already set to 700
**Goal220    5.105
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL220 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  235.769 SubGoal checking Altitude
VISUAL  236.836 atc Value random-listen
VISUAL  236.836 altitude Value 1109
**Goal223    5.124
   isa CHECK-ALTITUDE
   altitude 1109
   previous 1139GOAL223 DIAL DIAL T Ignore-Altitude
PROCEDURAL  237.494 SubGoal checking Autopilot
VISUAL  238.630 otw_runway Value out-of-sight
VISUAL  239.453 autopilots Value up
VISUAL  240.508 altitude Value 1087
**Goal225    7.687
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1087
   decision Engaged
   decision-altitude 600GOAL225 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  241.209 SubGoal checking Altitude
VISUAL  242.152 altitude Value 1077
**Goal229    5.020
   isa CHECK-ALTITUDE
   altitude 1077
   previous 1109GOAL229 DIAL DIAL T Ignore-Altitude
PROCEDURAL  242.810 SubGoal setting Dial Altitude
VISUAL  243.711 waypoint Value 4
RETRIEVAL  243.861 Altitude 700
VISUAL  245.076 dial-altitude Value 700
PROCEDURAL  245.126 Confirm Altitude already set to 700
```

```
**Goal231    5.101
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL231 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  245.732 SubGoal checking Altitude
VISUAL  246.837 altitude Value 1049
**Goal234    4.833
   isa CHECK-ALTITUDE
   altitude 1049
   previous 1077GOAL234 DIAL DIAL T Ignore-Altitude
PROCEDURAL  247.493 SubGoal setting Dial Altitude
VISUAL  248.459 waypoint Value 4
RETRIEVAL  248.609 Altitude 700
VISUAL  249.506 dial-altitude Value 700
PROCEDURAL  249.556 Confirm Altitude already set to 700
**Goal236    5.039
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL236 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  250.163 SubGoal checking Altitude
VISUAL  251.198 altitude Value 1023
**Goal239    4.489
   isa CHECK-ALTITUDE
   altitude 1023
   previous 1049GOAL239 DIAL DIAL T Ignore-Altitude
PROCEDURAL  251.855 SubGoal checking Autopilot
VISUAL  252.713 otw_runway Value out-of-sight
VISUAL  253.888 autopilots Value up
VISUAL  255.093 altitude Value 999
**Goal241    7.856
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 999
   decision Engaged
   decision-altitude 600GOAL241 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  255.794 SubGoal checking Altitude
VISUAL  257.090 altitude Value 972
**Goal245    5.365
   isa CHECK-ALTITUDE
   altitude 972
   previous 1023GOAL245 DIAL DIAL T Ignore-Altitude
PROCEDURAL  257.745 SubGoal checking Autopilot
VISUAL  258.617 otw_runway Value out-of-sight
VISUAL  259.876 autopilots Value up
VISUAL  261.013 altitude Value 920
**Goal247    7.653
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 920
   decision Engaged
   decision-altitude 600GOAL247 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  261.715 SubGoal checking Altitude
VISUAL  262.558 altitude Value 898
**Goal251    4.972
   isa CHECK-ALTITUDE
   altitude 898
   previous 972GOAL251 DIAL DIAL T Ignore-Altitude
```

```
 PROCEDURAL  263.214 SubGoal setting Dial Altitude
 VISUAL  264.320 waypoint Value 5
 RETRIEVAL  264.470 Altitude 500
 VISUAL  265.363 dial-altitude Value 700
 MANUAL  268.107 dial-altitude set 500
 **Goal253    5.135
    isa DIAL-ALTITUDE
    waypoint 5
    altitude 500GOAL253 DIAL DIAL T Dial-Altitude
 PROCEDURAL  268.714 SubGoal checking Altitude
 VISUAL  269.668 altitude Value 803
 **Goal257    5.000
    isa CHECK-ALTITUDE
    altitude 803
    previous 898GOAL257 DIAL DIAL T Ignore-Altitude
 PROCEDURAL  270.323 SubGoal checking Autopilot
 VISUAL  271.354 otw_runway Value in-sight
 VISUAL  272.515 autopilots Value up
 PROCEDURAL  272.565 Disengage Autopilot and land
 MANUAL  275.668 autopilots up/down 0
 **Goal259    9.786
    isa SET-AUTOPILOT
    visibility In-Sight
    peek nil
    decision Disengaged
    decision-altitude 600GOAL259 DIAL DIAL T Disengage-Autopilot


*** Finis  ***


*** Setting ModelDone to 1***

 MCP NAV PFD SVS CONTROLS OTW off Total-time
 26.735094 104.95264 82.22931 0 16.755093 18.946987 26.605118 276.22424
EMC End:T 276.22424

Look 1.0 Action 2.5 Listen 0.5 Ans 0.1


;; Factory is idle.
```

5-Baseline IMC Missed approach (go around)

```
dribbling to file "NASA-hpm-model-results.drb"

; Fast loading
;    C:\Documents and Settings\bbest\My Documents\Completed
Projects\NASA HEM\NasaHEMv07-Jul-
2005\nasav07\HPMv7\delivery\ole\client\autotool.fasl
;   Fast loading
;      C:\Documents and Settings\bbest\My Documents\Completed
Projects\NASA HEM\NasaHEMv07-Jul-
2005\nasav07\HPMv7\delivery\ole\client\idispatch.fasl
;   Fast loading
;      C:\Documents and Settings\bbest\My Documents\Completed
Projects\NASA HEM\NasaHEMv07-Jul-
2005\nasav07\HPMv7\delivery\ole\client\iclassfactory.fasl

Factory Started
CL-USER(1): (register-server)
Resistered Server EMC_NASAHPM.EMCReceiveCOMMessages
NIL
CL-USER(2):
Subject 0 Trial 0 Run 1
Initializing control

 Control    4.982
    isa CONTROL
    speed 200.0d0
    altitude 2500.0d0
    waypoint nil
    distance nil
    flaps 5
    decision-altitude 600
    landing-gear Up
    airbrakes Off
    autopilots Engaged
    task nil
    last-task nil
    status Active
    landing-checklist nil
 VISUAL    0.000 flaps Value 5
 CHUNK NIL IS UNDEFINED.
 CHUNK NIL IS UNDEFINED.
 PROCEDURAL    3.040 Preparing for approach: engaging Speed-brakes full
 MANUAL    3.040 airbrakes on/off 0
 PROCEDURAL    4.214 Preparing for approach: setting LNAV
 VISUAL    4.214 distance-next Value 1
 PROCEDURAL    5.463 Preparing for approach: engaging Autopilot
 VISUAL    5.463 autopilots Value up
 PROCEDURAL    6.519 Preparing for approach: setting VNAV
 VISUAL    6.519 waypoint Value 1
 PROCEDURAL    8.743 Preparing for approach: setting Flaps 1
 MANUAL    8.743 flaps set 1
 PROCEDURAL    8.900 SubGoal checking Speed Brakes
 VISUAL    9.780 speed Value 200
 VISUAL   10.993 airbrakes Value on
```

```
PROCEDURAL   11.043 Setting Speed Brakes
MANUAL   14.108 airbrakes on/off 0
**Goal6    8.464
   isa SPEED-BRAKES
   speed 200
   decision OffGOAL6 DIAL NIL NIL Set-Speed-Brakes
PROCEDURAL   15.708 SubGoal checking Autopilot
VISUAL   16.901 otw_runway Value out-of-sight
VISUAL   18.136 autopilots Value up
VISUAL   19.121 altitude Value 2500
**Goal10    8.729
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 2500
   decision Engaged
   decision-altitude 600GOAL10 DIAL NIL NIL Ignore-Autopilot
PROCEDURAL   20.822 SubGoal checking Landing Gear
VISUAL   21.882 waypoint Value 2
VISUAL   22.998 distance-next Value 4
RETRIEVAL   23.099 Waypoint 2 Next 4 Distance 15
VISUAL   24.028 landing-gear Value up
PROCEDURAL   24.078 Lowering Gear
MANUAL   25.972 landing-gear up/down 0
**Goal14    9.051
   isa MOVE-GEAR
   waypoint 2
   distance-next 4
   distance 15
   decision DownGOAL14 DIAL DIAL T Move-Gear
PROCEDURAL   26.579 SubGoal checking Altitude
VISUAL   27.658 altitude Value 2500
**Goal19    5.168
   isa CHECK-ALTITUDE
   altitude 2500
   previous 2500.0d0GOAL19 DIAL DIAL T Ignore-Altitude
PROCEDURAL   28.314 SubGoal setting Dial Altitude
VISUAL   29.430 waypoint Value 2
RETRIEVAL   29.580 Altitude 1800
VISUAL   30.623 dial-altitude Value 2500
MANUAL   32.824 dial-altitude set 1800
**Goal21    4.926
   isa DIAL-ALTITUDE
   waypoint 2
   altitude 1800GOAL21 DIAL DIAL T Dial-Altitude
PROCEDURAL   33.431 SubGoal checking Speed
VISUAL   34.232 waypoint Value 2
VISUAL   35.275 distance-next Value 3
RETRIEVAL   35.375 Waypoint 2 Next 3 Distance 14
RETRIEVAL   35.475 Speed
VISUAL   36.624 dial-speed Value 200
MANUAL   39.723 dial-speed set 160
**Goal25    4.740
   isa SET-SPEED
   waypoint 2
   distance-next 3
   distance 14
   speed 160GOAL25 DIAL DIAL T Dial-Speed
```

```
PROCEDURAL   40.329 SubGoal checking Flaps
VISUAL   41.172 speed Value 199
RETRIEVAL   41.372 Flaps 15
VISUAL   42.482 flaps Value 1
MANUAL   44.940 flaps set 15
**Goal30    5.038
   isa SET-FLAP
   speed 199
   flap 15GOAL30 DIAL DIAL T Set-Flaps
PROCEDURAL   45.547 SubGoal checking Decision Altitude
VISUAL   46.484 waypoint Value 2
VISUAL   47.772 distance-next Value 2
RETRIEVAL   47.872 Waypoint 2 Next 2 Distance 13
**Goal34    4.840
   isa SET-DECISION-ALTITUDE
   waypoint 2
   distance-next 2
   distance 13
   old 600
   decision 600GOAL34 DIAL DIAL T Ignore-Decision-Altitude
PROCEDURAL   48.531 SubGoal checking Autopilot
VISUAL   49.698 otw_runway Value out-of-sight
VISUAL   50.706 autopilots Value up
VISUAL   51.919 altitude Value 2500
**Goal37    8.445
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 2500
   decision Engaged
   decision-altitude 600GOAL37 DIAL DIAL T Ignore-Autopilot
PROCEDURAL   52.620 SubGoal checking Altitude
VISUAL   53.659 altitude Value 2500
**Goal41    4.925
   isa CHECK-ALTITUDE
   altitude 2500
   previous 2500GOAL41 DIAL DIAL T Ignore-Altitude
PROCEDURAL   54.317 SubGoal checking Speed Brakes
VISUAL   55.552 speed Value 187
VISUAL   56.523 airbrakes Value off
**Goal43    8.692
   isa SPEED-BRAKES
   speed 187
   decision OffGOAL43 DIAL DIAL T Decide-Speed-Brakes
PROCEDURAL   57.123 SubGoal setting Dial Altitude
VISUAL   57.967 waypoint Value 2
RETRIEVAL   58.117 Altitude 1800
VISUAL   59.327 dial-altitude Value 1800
PROCEDURAL   59.377 Confirm Altitude already set to 1800
**Goal46    5.152
   isa DIAL-ALTITUDE
   waypoint 2
   altitude 1800GOAL46 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL   59.982 SubGoal checking Landing Gear
VISUAL   61.038 waypoint Value 2
VISUAL   61.976 distance-next Value 1
RETRIEVAL   62.077 Waypoint 2 Next 1 Distance 12
VISUAL   63.251 landing-gear Value down
```

```
**Goal49    8.578
   isa MOVE-GEAR
   waypoint 2
   distance-next 1
   distance 12
   decision DownGOAL49 DIAL DIAL T Decide-Gear
PROCEDURAL   63.851 SubGoal checking Decision Altitude
VISUAL   65.059 waypoint Value 2
VISUAL   66.204 distance-next Value 1
RETRIEVAL   66.304 Waypoint 2 Next 1 Distance 12
**Goal53    5.141
   isa SET-DECISION-ALTITUDE
   waypoint 2
   distance-next 1
   distance 12
   old 600
   decision 600GOAL53 DIAL DIAL T Ignore-Decision-Altitude
PROCEDURAL   66.959 SubGoal checking Speed
VISUAL   67.816 waypoint Value 2
VISUAL   68.896 distance-next Value 1
RETRIEVAL   68.996 Waypoint 2 Next 1 Distance 12
RETRIEVAL   69.096 Speed
VISUAL   70.083 dial-speed Value 160
MANUAL   72.368 dial-speed set 140
**Goal56    4.859
   isa SET-SPEED
   waypoint 2
   distance-next 1
   distance 12
   speed 140GOAL56 DIAL DIAL T Dial-Speed
PROCEDURAL   72.976 SubGoal checking Flaps
VISUAL   73.916 speed Value 173
RETRIEVAL   74.066 Flaps 25
VISUAL   75.192 flaps Value 15
MANUAL   77.662 flaps set 25
**Goal61    4.932
   isa SET-FLAP
   speed 173
   flap 25GOAL61 DIAL DIAL T Set-Flaps
PROCEDURAL   78.267 SubGoal checking Altitude
VISUAL   79.270 altitude Value 2500
**Goal65    4.909
   isa CHECK-ALTITUDE
   altitude 2500
   previous 2500GOAL65 DIAL DIAL T Ignore-Altitude
PROCEDURAL   79.928 SubGoal setting Dial Altitude
VISUAL   80.858 atc Value random-listen
VISUAL   80.858 waypoint Value 2
RETRIEVAL   81.008 Altitude 1800
VISUAL   82.231 atc Value ten-miles-out
VISUAL   82.231 dial-altitude Value 1800
PROCEDURAL   82.281 Confirm Altitude already set to 1800
**Goal67    4.701
   isa DIAL-ALTITUDE
   waypoint 2
   altitude 1800GOAL67 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL   82.889 SubGoal checking Decision Altitude
```

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VISUAL   84.030 waypoint Value 3
VISUAL   85.278 distance-next Value 2
RETRIEVAL   85.379 Waypoint 3 Next 2 Distance 11
**Goal70    5.027
   isa SET-DECISION-ALTITUDE
   waypoint 3
   distance-next 2
   distance 11
   old 600
   decision 600GOAL70 DIAL DIAL T Ignore-Decision-Altitude
PROCEDURAL   86.035 SubGoal checking Autopilot
VISUAL   87.046 otw_runway Value out-of-sight
VISUAL   88.013 autopilots Value up
VISUAL   89.200 altitude Value 2361
**Goal73    8.683
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 2361
   decision Engaged
   decision-altitude 600GOAL73 DIAL DIAL T Ignore-Autopilot
PROCEDURAL   89.900 SubGoal checking Speed Brakes
VISUAL   90.891 speed Value 160
VISUAL   91.817 airbrakes Value off
**Goal77    8.511
   isa SPEED-BRAKES
   speed 160
   decision OffGOAL77 DIAL DIAL T Decide-Speed-Brakes
PROCEDURAL   92.417 SubGoal checking Landing Gear
VISUAL   93.297 waypoint Value 3
VISUAL   94.321 distance-next Value 1
RETRIEVAL   94.421 Waypoint 3 Next 1 Distance 10
VISUAL   95.340 landing-gear Value down
**Goal80    8.096
   isa MOVE-GEAR
   waypoint 3
   distance-next 1
   distance 10
   decision DownGOAL80 DIAL DIAL T Decide-Gear
PROCEDURAL   95.940 SubGoal checking Decision Altitude
VISUAL   96.767 waypoint Value 3
VISUAL   97.909 distance-next Value 1
RETRIEVAL   98.009 Waypoint 3 Next 1 Distance 10
**Goal84    4.882
   isa SET-DECISION-ALTITUDE
   waypoint 3
   distance-next 1
   distance 10
   old 600
   decision 600GOAL84 DIAL DIAL T Ignore-Decision-Altitude
PROCEDURAL   98.666 SubGoal checking Altitude
VISUAL   99.747 altitude Value 2173
**Goal87    5.153
   isa CHECK-ALTITUDE
   altitude 2173
   previous 2500GOAL87 DIAL DIAL T Read-Altitude
PROCEDURAL  100.405 SubGoal checking Flaps
VISUAL  101.649 speed Value 157
```

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RETRIEVAL  101.799 Flaps 20
VISUAL  102.782 flaps Value 25
MANUAL  105.332 flaps set 20
**Goal89    5.151
   isa SET-FLAP
   speed 157
   flap 20GOAL89 DIAL DIAL T Set-Flaps
PROCEDURAL  105.939 SubGoal checking Altitude
VISUAL  107.101 altitude Value 2044
**Goal93    4.835
   isa CHECK-ALTITUDE
   altitude 2044
   previous 2173GOAL93 DIAL DIAL T Ignore-Altitude
PROCEDURAL  107.759 SubGoal checking Speed Brakes
VISUAL  108.619 speed Value 156
VISUAL  109.701 airbrakes Value off
**Goal95    8.365
   isa SPEED-BRAKES
   speed 156
   decision OffGOAL95 DIAL DIAL T Decide-Speed-Brakes
PROCEDURAL  110.301 SubGoal setting Dial Altitude
VISUAL  111.542 waypoint Value 3
RETRIEVAL  111.692 Altitude 1000
VISUAL  112.466 dial-altitude Value 1800
MANUAL  114.670 dial-altitude set 1000
**Goal98    5.214
   isa DIAL-ALTITUDE
   waypoint 3
   altitude 1000GOAL98 DIAL DIAL T Dial-Altitude
PROCEDURAL  115.277 SubGoal checking Speed
VISUAL  116.230 waypoint Value 3
VISUAL  117.229 distance-next Value 0
RETRIEVAL  117.329 Waypoint 3 Next 0 Distance 9
RETRIEVAL  117.429 Speed
VISUAL  118.404 dial-speed Value 140
PROCEDURAL  118.454 Confirm Speed already set to 140
**Goal102    5.268
   isa SET-SPEED
   waypoint 3
   distance-next 0
   distance 9
   speed 140GOAL102 DIAL DIAL T Speed-Already-Dialed
PROCEDURAL  119.061 SubGoal checking Decision Altitude
VISUAL  120.239 waypoint Value 3
VISUAL  121.303 distance-next Value 6
RETRIEVAL  121.403 Waypoint 3 Next 6 Distance 15
**Goal106    4.889
   isa SET-DECISION-ALTITUDE
   waypoint 3
   distance-next 6
   distance 15
   old 600
   decision 600GOAL106 DIAL DIAL T Ignore-Decision-Altitude
PROCEDURAL  122.060 SubGoal checking Landing Gear
VISUAL  122.870 waypoint Value 4
VISUAL  124.129 distance-next Value 6
RETRIEVAL  124.229 Waypoint 4 Next 6 Distance 9
```

```
VISUAL  125.384 landing-gear Value down
**Goal109    8.076
   isa MOVE-GEAR
   waypoint 4
   distance-next 6
   distance 9
   decision DownGOAL109 DIAL DIAL T Decide-Gear
PROCEDURAL  125.984 SubGoal checking Altitude
VISUAL  126.972 altitude Value 1763
**Goal113    5.091
   isa CHECK-ALTITUDE
   altitude 1763
   previous 2044GOAL113 DIAL DIAL T Read-Altitude
PROCEDURAL  127.629 SubGoal checking Autopilot
VISUAL  128.632 otw_runway Value out-of-sight
VISUAL  129.507 autopilots Value up
VISUAL  130.405 altitude Value 1741
**Goal115    8.541
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1741
   decision Engaged
   decision-altitude 600GOAL115 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  131.106 SubGoal checking Altitude
VISUAL  132.206 altitude Value 1729
**Goal119    4.594
   isa CHECK-ALTITUDE
   altitude 1729
   previous 1763GOAL119 DIAL DIAL T Ignore-Altitude
PROCEDURAL  132.864 SubGoal setting Dial Altitude
VISUAL  133.924 waypoint Value 4
RETRIEVAL  134.074 Altitude 700
VISUAL  134.855 dial-altitude Value 1000
MANUAL  137.476 dial-altitude set 700
**Goal121    5.244
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL121 DIAL DIAL T Dial-Altitude
PROCEDURAL  138.084 SubGoal completing landing checklist
PROCEDURAL  140.787 Landing checklist: setting Flaps 15
MANUAL  140.787 flaps set 15
PROCEDURAL  144.602 Landing checklist: setting Speed-brakes to armed
MANUAL  144.602 airbrakes on/off 0
PROCEDURAL  146.992 Landing checklist: setting Gear down 1
MANUAL  146.992 landing-gear up/down 0
PROCEDURAL  149.212 Landing checklist: setting Speed to 135
MANUAL  149.212 speed set 135
VISUAL  149.212 speed Value 147
PROCEDURAL  151.959 Landing checklist: preparing cabin for landing
VOCAL  151.959 nothing communication 2007
VOCAL  152.009 Landing Checklist Complete
PROCEDURAL  152.166 SubGoal checking Altitude
VISUAL  153.370 altitude Value 1595
**Goal132    4.792
   isa CHECK-ALTITUDE
   altitude 1595
   previous 1729GOAL132 DIAL DIAL T Ignore-Altitude
```

```
PROCEDURAL  154.027 SubGoal setting Dial Altitude
VISUAL  155.188 waypoint Value 4
RETRIEVAL  155.338 Altitude 700
VISUAL  156.229 dial-altitude Value 700
PROCEDURAL  156.279 Confirm Altitude already set to 700
**Goal134    4.919
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL134 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  156.885 SubGoal checking Autopilot
VISUAL  157.819 otw_runway Value out-of-sight
VISUAL  159.102 atc Value random-listen
VISUAL  159.102 autopilots Value up
VISUAL  160.144 altitude Value 1553
**Goal137    8.193
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1553
   decision Engaged
   decision-altitude 600GOAL137 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  160.846 SubGoal checking Altitude
VISUAL  162.012 altitude Value 1542
**Goal141    4.782
   isa CHECK-ALTITUDE
   altitude 1542
   previous 1595GOAL141 DIAL DIAL T Ignore-Altitude
PROCEDURAL  162.668 SubGoal setting Dial Altitude
VISUAL  163.634 waypoint Value 4
RETRIEVAL  163.784 Altitude 700
VISUAL  164.984 dial-altitude Value 700
PROCEDURAL  165.034 Confirm Altitude already set to 700
**Goal143    4.718
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL143 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  165.641 SubGoal checking Altitude
VISUAL  166.801 altitude Value 1512
**Goal146    5.023
   isa CHECK-ALTITUDE
   altitude 1512
   previous 1542GOAL146 DIAL DIAL T Ignore-Altitude
PROCEDURAL  167.459 SubGoal checking Autopilot
VISUAL  168.368 otw_runway Value out-of-sight
VISUAL  169.303 autopilots Value up
VISUAL  170.340 altitude Value 1490
**Goal148    8.156
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1490
   decision Engaged
   decision-altitude 600GOAL148 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  171.041 SubGoal checking Altitude
VISUAL  171.976 altitude Value 1481
**Goal152    5.259
   isa CHECK-ALTITUDE
   altitude 1481
   previous 1512GOAL152 DIAL DIAL T Ignore-Altitude
```

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PROCEDURAL  172.631 SubGoal setting Dial Altitude
VISUAL  173.855 waypoint Value 4
RETRIEVAL  174.005 Altitude 700
VISUAL  174.942 dial-altitude Value 700
PROCEDURAL  174.992 Confirm Altitude already set to 700
**Goal154    5.083
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL154 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  175.599 SubGoal checking Altitude
VISUAL  176.731 altitude Value 1452
**Goal157    5.196
   isa CHECK-ALTITUDE
   altitude 1452
   previous 1481GOAL157 DIAL DIAL T Ignore-Altitude
PROCEDURAL  177.388 SubGoal checking Autopilot
VISUAL  178.301 otw_runway Value out-of-sight
VISUAL  179.406 autopilots Value up
VISUAL  180.541 altitude Value 1429
**Goal159    8.292
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1429
   decision Engaged
   decision-altitude 600GOAL159 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  181.242 SubGoal checking Altitude
VISUAL  182.236 altitude Value 1419
**Goal163    5.189
   isa CHECK-ALTITUDE
   altitude 1419
   previous 1452GOAL163 DIAL DIAL T Ignore-Altitude
PROCEDURAL  182.893 SubGoal setting Dial Altitude
VISUAL  183.994 waypoint Value 4
RETRIEVAL  184.144 Altitude 700
VISUAL  185.212 dial-altitude Value 700
PROCEDURAL  185.262 Confirm Altitude already set to 700
**Goal165    5.154
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL165 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  185.868 SubGoal checking Altitude
VISUAL  186.680 altitude Value 1392
**Goal168    4.782
   isa CHECK-ALTITUDE
   altitude 1392
   previous 1419GOAL168 DIAL DIAL T Ignore-Altitude
PROCEDURAL  187.337 SubGoal checking Autopilot
VISUAL  188.486 otw_runway Value out-of-sight
VISUAL  189.437 autopilots Value up
VISUAL  190.271 altitude Value 1371
**Goal170    8.360
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1371
   decision Engaged
   decision-altitude 600GOAL170 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  190.972 SubGoal checking Altitude
```

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VISUAL  192.207 altitude Value 1359
**Goal174    4.999
   isa CHECK-ALTITUDE
   altitude 1359
   previous 1392GOAL174 DIAL DIAL T Ignore-Altitude
PROCEDURAL  192.867 SubGoal setting Dial Altitude
VISUAL  193.831 waypoint Value 4
RETRIEVAL  193.981 Altitude 700
VISUAL  195.055 dial-altitude Value 700
PROCEDURAL  195.105 Confirm Altitude already set to 700
**Goal176    5.111
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL176 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  195.711 SubGoal checking Altitude
VISUAL  196.517 altitude Value 1334
**Goal179    5.129
   isa CHECK-ALTITUDE
   altitude 1334
   previous 1359GOAL179 DIAL DIAL T Ignore-Altitude
PROCEDURAL  197.173 SubGoal checking Autopilot
VISUAL  198.117 otw_runway Value out-of-sight
VISUAL  199.276 autopilots Value up
VISUAL  200.369 altitude Value 1310
**Goal181    7.843
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1310
   decision Engaged
   decision-altitude 600GOAL181 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  201.071 SubGoal checking Altitude
VISUAL  202.016 altitude Value 1301
**Goal185    5.099
   isa CHECK-ALTITUDE
   altitude 1301
   previous 1334GOAL185 DIAL DIAL T Ignore-Altitude
PROCEDURAL  202.672 SubGoal setting Dial Altitude
VISUAL  203.891 waypoint Value 4
RETRIEVAL  204.041 Altitude 700
VISUAL  205.005 dial-altitude Value 700
PROCEDURAL  205.055 Confirm Altitude already set to 700
**Goal187    4.901
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL187 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  205.662 SubGoal checking Altitude
VISUAL  206.915 altitude Value 1272
**Goal190    4.712
   isa CHECK-ALTITUDE
   altitude 1272
   previous 1301GOAL190 DIAL DIAL T Ignore-Altitude
PROCEDURAL  207.571 SubGoal checking Autopilot
VISUAL  208.453 otw_runway Value out-of-sight
VISUAL  209.532 autopilots Value up
VISUAL  210.439 altitude Value 1251
**Goal192    7.714
   isa SET-AUTOPILOT
```

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   visibility Out-Of-Sight
   peek 1251
   decision Engaged
   decision-altitude 600GOAL192 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  211.140 SubGoal checking Altitude
VISUAL  212.270 altitude Value 1239
**Goal196    4.757
   isa CHECK-ALTITUDE
   altitude 1239
   previous 1272GOAL196 DIAL DIAL T Ignore-Altitude
PROCEDURAL  212.927 SubGoal checking Autopilot
VISUAL  214.200 otw_runway Value out-of-sight
VISUAL  215.482 autopilots Value up
VISUAL  216.475 altitude Value 1214
**Goal198    7.820
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1214
   decision Engaged
   decision-altitude 600GOAL198 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  217.176 SubGoal checking Altitude
VISUAL  218.044 altitude Value 1205
**Goal202    4.825
   isa CHECK-ALTITUDE
   altitude 1205
   previous 1239GOAL202 DIAL DIAL T Ignore-Altitude
PROCEDURAL  218.700 SubGoal setting Dial Altitude
VISUAL  219.968 waypoint Value 4
RETRIEVAL  220.118 Altitude 700
VISUAL  220.940 dial-altitude Value 700
PROCEDURAL  220.990 Confirm Altitude already set to 700
**Goal204    4.972
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL204 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  221.595 SubGoal checking Altitude
VISUAL  222.735 altitude Value 1177
**Goal207    5.239
   isa CHECK-ALTITUDE
   altitude 1177
   previous 1205GOAL207 DIAL DIAL T Ignore-Altitude
PROCEDURAL  223.391 SubGoal setting Dial Altitude
VISUAL  224.479 waypoint Value 4
RETRIEVAL  224.629 Altitude 700
VISUAL  225.418 dial-altitude Value 700
PROCEDURAL  225.468 Confirm Altitude already set to 700
**Goal209    5.206
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL209 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  226.073 SubGoal checking Altitude
VISUAL  227.355 altitude Value 1149
**Goal212    5.009
   isa CHECK-ALTITUDE
   altitude 1149
   previous 1177GOAL212 DIAL DIAL T Ignore-Altitude
PROCEDURAL  228.013 SubGoal setting Dial Altitude
```

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VISUAL  228.989 waypoint Value 4
RETRIEVAL  229.139 Altitude 700
VISUAL  229.944 dial-altitude Value 700
PROCEDURAL  229.994 Confirm Altitude already set to 700
**Goal214    4.963
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL214 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  230.600 SubGoal checking Altitude
VISUAL  231.505 altitude Value 1125
**Goal217    4.996
   isa CHECK-ALTITUDE
   altitude 1125
   previous 1149GOAL217 DIAL DIAL T Ignore-Altitude
PROCEDURAL  232.164 SubGoal setting Dial Altitude
VISUAL  233.224 waypoint Value 4
RETRIEVAL  233.374 Altitude 700
VISUAL  234.235 dial-altitude Value 700
PROCEDURAL  234.285 Confirm Altitude already set to 700
**Goal219    4.851
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL219 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  234.893 SubGoal checking Altitude
VISUAL  235.780 altitude Value 1099
**Goal222    4.835
   isa CHECK-ALTITUDE
   altitude 1099
   previous 1125GOAL222 DIAL DIAL T Ignore-Altitude
PROCEDURAL  236.437 SubGoal setting Dial Altitude
VISUAL  237.240 waypoint Value 4
RETRIEVAL  237.440 Altitude 700
VISUAL  238.329 dial-altitude Value 700
PROCEDURAL  238.379 Confirm Altitude already set to 700
**Goal224    5.017
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL224 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  238.985 SubGoal checking Altitude
VISUAL  240.160 atc Value random-listen
VISUAL  240.160 altitude Value 1073
**Goal227    4.975
   isa CHECK-ALTITUDE
   altitude 1073
   previous 1099GOAL227 DIAL DIAL T Ignore-Altitude
PROCEDURAL  240.817 SubGoal checking Autopilot
VISUAL  241.729 otw_runway Value out-of-sight
VISUAL  242.719 autopilots Value up
VISUAL  243.890 altitude Value 1051
**Goal229    7.530
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1051
   decision Engaged
   decision-altitude 600GOAL229 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  244.591 SubGoal checking Altitude
VISUAL  245.606 altitude Value 1040
```

```
**Goal233    4.976
   isa CHECK-ALTITUDE
   altitude 1040
   previous 1073GOAL233 DIAL DIAL T Ignore-Altitude
PROCEDURAL  246.261 SubGoal checking Autopilot
VISUAL  247.524 otw_runway Value out-of-sight
VISUAL  248.819 autopilots Value up
VISUAL  250.040 altitude Value 1014
**Goal235    7.805
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1014
   decision Engaged
   decision-altitude 600GOAL235 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  250.741 SubGoal checking Altitude
VISUAL  252.022 altitude Value 1002
**Goal239    5.514
   isa CHECK-ALTITUDE
   altitude 1002
   previous 1040GOAL239 DIAL DIAL T Ignore-Altitude
PROCEDURAL  252.679 SubGoal setting Dial Altitude
VISUAL  253.965 waypoint Value 5
RETRIEVAL  254.115 Altitude 500
VISUAL  255.355 dial-altitude Value 700
MANUAL  257.865 dial-altitude set 500
**Goal241    5.009
   isa DIAL-ALTITUDE
   waypoint 5
   altitude 500GOAL241 DIAL DIAL T Dial-Altitude
PROCEDURAL  258.473 SubGoal checking Altitude
VISUAL  259.278 altitude Value 907
**Goal245    4.977
   isa CHECK-ALTITUDE
   altitude 907
   previous 1002GOAL245 DIAL DIAL T Ignore-Altitude
PROCEDURAL  259.935 SubGoal checking Autopilot
VISUAL  260.930 otw_runway Value out-of-sight
VISUAL  261.931 autopilots Value up
VISUAL  262.756 altitude Value 860
**Goal247    7.832
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 860
   decision Engaged
   decision-altitude 600GOAL247 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  263.457 SubGoal checking Altitude
VISUAL  264.730 altitude Value 834
**Goal251    5.104
   isa CHECK-ALTITUDE
   altitude 834
   previous 907GOAL251 DIAL DIAL T Ignore-Altitude
PROCEDURAL  265.387 SubGoal setting Dial Altitude
VISUAL  266.291 waypoint Value 5
RETRIEVAL  266.441 Altitude 500
VISUAL  267.289 dial-altitude Value 500
PROCEDURAL  267.339 Confirm Altitude already set to 500
**Goal253    4.997
```

```
    isa DIAL-ALTITUDE
    waypoint 5
    altitude 500GOAL253 DIAL DIAL T Dial-Altitude-Already-Dialed
 PROCEDURAL  267.944 SubGoal checking Altitude
 VISUAL  268.850 altitude Value 779
 **Goal256    5.001
    isa CHECK-ALTITUDE
    altitude 779
    previous 834GOAL256 DIAL DIAL T Ignore-Altitude
 PROCEDURAL  269.506 SubGoal setting Dial Altitude
 VISUAL  270.440 waypoint Value 5
 RETRIEVAL  270.590 Altitude 500
 VISUAL  271.503 dial-altitude Value 500
 PROCEDURAL  271.553 Confirm Altitude already set to 500
 **Goal258    5.005
    isa DIAL-ALTITUDE
    waypoint 5
    altitude 500GOAL258 DIAL DIAL T Dial-Altitude-Already-Dialed
 PROCEDURAL  272.159 SubGoal checking Autopilot
 VISUAL  273.362 otw_runway Value out-of-sight
 VISUAL  274.177 autopilots Value up
 VISUAL  275.013 altitude Value 692
 **Goal261    7.514
    isa SET-AUTOPILOT
    visibility Out-Of-Sight
    peek 692
    decision Engaged
    decision-altitude 600GOAL261 DIAL DIAL T Ignore-Autopilot
 PROCEDURAL  275.714 SubGoal checking Altitude
 VISUAL  276.814 altitude Value 649
 **Goal265    4.952
    isa CHECK-ALTITUDE
    altitude 649
    previous 779GOAL265 DIAL DIAL T Ignore-Altitude
 PROCEDURAL  277.470 SubGoal checking Autopilot
 VISUAL  278.593 otw_runway Value out-of-sight
 VISUAL  279.423 autopilots Value up
 VISUAL  280.568 altitude Value 584
 **Goal267    7.737
    isa SET-AUTOPILOT
    visibility Out-Of-Sight
    peek 584
    decision Engaged
    decision-altitude 600GOAL267 DIAL DIAL T Ignore-Autopilot
 PROCEDURAL  281.270 SubGoal checking Altitude
 VISUAL  282.071 altitude Value 567
 **Goal271    4.945
    isa CHECK-ALTITUDE
    altitude 567
    previous 649GOAL271 DIAL DIAL T Ignore-Altitude
 PROCEDURAL  284.918 Missed Approach (Altitude below decision
altitude!)
*** Setting ModelDone to 3***

 MCP NAV PFD SVS CONTROLS OTW off Total-time
 27.144083 107.32467 83.37073 0 16.39315 18.346 32.339813 284.91846
EMC End:T 284.91846
```

```
Look 1.0 Action 2.5 Listen 0.5 Ans 0.1

;; Factory is idle.
```

6-Baseline IMC Terrain mismatch

```
dribbling to file "NASA-hpm-model-results.drb"

; Fast loading
;    C:\Documents and Settings\bbest\My Documents\Completed
Projects\NASA HEM\NasaHEMv07-Jul-
2005\nasav07\HPMv7\delivery\ole\client\autotool.fasl
;   Fast loading
;      C:\Documents and Settings\bbest\My Documents\Completed
Projects\NASA HEM\NasaHEMv07-Jul-
2005\nasav07\HPMv7\delivery\ole\client\idispatch.fasl
;   Fast loading
;      C:\Documents and Settings\bbest\My Documents\Completed
Projects\NASA HEM\NasaHEMv07-Jul-
2005\nasav07\HPMv7\delivery\ole\client\iclassfactory.fasl

Factory Started
CL-USER(1): (register-server)
Resistered Server EMC_NASAHPM.EMCReceiveCOMMessages
NIL
CL-USER(2):
Subject 0 Trial 0 Run 1
Initializing control

 Control    4.784
    isa CONTROL
    speed 200.0d0
    altitude 2500.0d0
    waypoint nil
    distance nil
    flaps 5
    decision-altitude 600
    landing-gear Up
    airbrakes Off
    autopilots Engaged
    task nil
    last-task nil
    status Active
    landing-checklist nil
 VISUAL    0.000 flaps Value 5
 CHUNK NIL IS UNDEFINED.
 CHUNK NIL IS UNDEFINED.
 PROCEDURAL    0.938 Preparing for approach: setting VNAV
 VISUAL    0.938 waypoint Value 1
 PROCEDURAL    2.160 Preparing for approach: setting LNAV
 VISUAL    2.160 distance-next Value 1
 PROCEDURAL    3.312 Preparing for approach: engaging Autopilot
 VISUAL    3.312 autopilots Value up
 PROCEDURAL    5.716 Preparing for approach: setting Flaps 1
 MANUAL    5.716 flaps set 1
 PROCEDURAL    9.710 Preparing for approach: engaging Speed-brakes full
 MANUAL    9.710 airbrakes on/off 0
 PROCEDURAL    9.866 SubGoal checking Flaps
 VISUAL   10.720 speed Value 200
 RETRIEVAL   10.870 Flaps 15
```

```
VISUAL   11.856 flaps Value 1
MANUAL   14.984 flaps set 15
**Goal6    4.873
   isa SET-FLAP
   speed 200
   flap 15GOAL6 DIAL NIL NIL Set-Flaps
PROCEDURAL   16.593 SubGoal setting Dial Altitude
VISUAL   17.740 waypoint Value 2
RETRIEVAL   17.940 Altitude 1800
VISUAL   18.812 dial-altitude Value 2500
MANUAL   21.807 dial-altitude set 1800
**Goal10    5.015
   isa DIAL-ALTITUDE
   waypoint 2
   altitude 1800GOAL10 DIAL DIAL T Dial-Altitude
PROCEDURAL   22.415 SubGoal checking Decision Altitude
VISUAL   23.552 waypoint Value 2
VISUAL   24.658 distance-next Value 3
RETRIEVAL   24.758 Waypoint 2 Next 3 Distance 14
**Goal14    5.131
   isa SET-DECISION-ALTITUDE
   waypoint 2
   distance-next 3
   distance 14
   old 600
   decision 600GOAL14 DIAL DIAL T Ignore-Decision-Altitude
PROCEDURAL   25.415 SubGoal checking Autopilot
VISUAL   26.304 otw_runway Value out-of-sight
VISUAL   27.243 autopilots Value up
VISUAL   28.056 altitude Value 2500
**Goal17    8.537
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 2500
   decision Engaged
   decision-altitude 600GOAL17 DIAL DIAL T Ignore-Autopilot
PROCEDURAL   28.757 SubGoal checking Altitude
VISUAL   29.797 altitude Value 2500
**Goal21    5.009
   isa CHECK-ALTITUDE
   altitude 2500
   previous 2500.0d0GOAL21 DIAL DIAL T Ignore-Altitude
PROCEDURAL   30.452 SubGoal checking Speed Brakes
VISUAL   31.533 speed Value 200
VISUAL   32.389 airbrakes Value on
PROCEDURAL   32.439 Setting Speed Brakes
MANUAL   34.860 airbrakes on/off 0
**Goal23    8.623
   isa SPEED-BRAKES
   speed 200
   decision OffGOAL23 DIAL DIAL T Set-Speed-Brakes
PROCEDURAL   35.460 SubGoal checking Landing Gear
VISUAL   36.608 waypoint Value 2
VISUAL   37.900 distance-next Value 3
RETRIEVAL   38.000 Waypoint 2 Next 3 Distance 14
VISUAL   38.968 landing-gear Value up
PROCEDURAL   39.018 Lowering Gear
```

```
MANUAL   41.103 landing-gear up/down 0
**Goal27    8.867
   isa MOVE-GEAR
   waypoint 2
   distance-next 3
   distance 14
   decision DownGOAL27 DIAL DIAL T Move-Gear
PROCEDURAL   41.709 SubGoal checking Speed
VISUAL   42.543 waypoint Value 2
VISUAL   43.665 distance-next Value 2
RETRIEVAL   43.765 Waypoint 2 Next 2 Distance 13
RETRIEVAL   43.865 Speed
VISUAL   44.937 dial-speed Value 200
MANUAL   47.681 dial-speed set 165
**Goal32    5.060
   isa SET-SPEED
   waypoint 2
   distance-next 2
   distance 13
   speed 165GOAL32 DIAL DIAL T Dial-Speed
PROCEDURAL   48.287 SubGoal checking Decision Altitude
VISUAL   49.357 waypoint Value 2
VISUAL   50.596 distance-next Value 2
RETRIEVAL   50.696 Waypoint 2 Next 2 Distance 13
**Goal37    5.121
   isa SET-DECISION-ALTITUDE
   waypoint 2
   distance-next 2
   distance 13
   old 600
   decision 600GOAL37 DIAL DIAL T Ignore-Decision-Altitude
PROCEDURAL   51.356 SubGoal checking Altitude
VISUAL   52.554 altitude Value 2500
**Goal40    4.718
   isa CHECK-ALTITUDE
   altitude 2500
   previous 2500GOAL40 DIAL DIAL T Ignore-Altitude
PROCEDURAL   53.212 SubGoal checking Autopilot
VISUAL   54.153 otw_runway Value out-of-sight
VISUAL   55.421 autopilots Value up
VISUAL   56.272 altitude Value 2500
**Goal42    8.771
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 2500
   decision Engaged
   decision-altitude 600GOAL42 DIAL DIAL T Ignore-Autopilot
PROCEDURAL   56.972 SubGoal checking Flaps
VISUAL   58.100 speed Value 192
RETRIEVAL   58.250 Flaps 1
VISUAL   59.323 flaps Value 15
MANUAL   61.524 flaps set 1
**Goal46    5.563
   isa SET-FLAP
   speed 192
   flap 1GOAL46 DIAL DIAL T Set-Flaps
PROCEDURAL   62.132 SubGoal setting Dial Altitude
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VISUAL   63.166 waypoint Value 2
RETRIEVAL   63.316 Altitude 1800
VISUAL   64.462 dial-altitude Value 1800
PROCEDURAL   64.512 Confirm Altitude already set to 1800
**Goal50    4.963
   isa DIAL-ALTITUDE
   waypoint 2
   altitude 1800GOAL50 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL   65.119 SubGoal checking Speed Brakes
VISUAL   66.393 speed Value 185
VISUAL   67.307 airbrakes Value off
**Goal53    8.568
   isa SPEED-BRAKES
   speed 185
   decision OffGOAL53 DIAL DIAL T Decide-Speed-Brakes
PROCEDURAL   67.907 SubGoal checking Landing Gear
VISUAL   68.888 waypoint Value 2
VISUAL   70.015 distance-next Value 1
RETRIEVAL   70.115 Waypoint 2 Next 1 Distance 12
VISUAL   71.172 landing-gear Value down
**Goal56    8.360
   isa MOVE-GEAR
   waypoint 2
   distance-next 1
   distance 12
   decision DownGOAL56 DIAL DIAL T Decide-Gear
PROCEDURAL   71.772 SubGoal checking Altitude
VISUAL   72.724 altitude Value 2500
**Goal60    5.235
   isa CHECK-ALTITUDE
   altitude 2500
   previous 2500GOAL60 DIAL DIAL T Ignore-Altitude
PROCEDURAL   73.383 SubGoal checking Speed
VISUAL   74.307 waypoint Value 2
VISUAL   75.314 distance-next Value 0
RETRIEVAL   75.414 Waypoint 2 Next 0 Distance 11
RETRIEVAL   75.514 Speed
VISUAL   76.602 dial-speed Value 165
PROCEDURAL   76.652 Confirm Speed already set to 165
**Goal62    4.995
   isa SET-SPEED
   waypoint 2
   distance-next 0
   distance 11
   speed 165GOAL62 DIAL DIAL T Speed-Already-Dialed
PROCEDURAL   77.257 SubGoal checking Decision Altitude
VISUAL   78.149 waypoint Value 2
VISUAL   79.120 distance-next Value 0
RETRIEVAL   79.220 Waypoint 2 Next 0 Distance 11
**Goal66    5.056
   isa SET-DECISION-ALTITUDE
   waypoint 2
   distance-next 0
   distance 11
   old 600
   decision 600GOAL66 DIAL DIAL T Ignore-Decision-Altitude
PROCEDURAL   79.879 SubGoal checking Autopilot
```

```
VISUAL   81.031 atc Value random-listen
VISUAL   81.031 atc Value ten-miles-out
VISUAL   81.031 otw_runway Value out-of-sight
VISUAL   82.000 autopilots Value up
VISUAL   83.171 altitude Value 2442
**Goal69    8.719
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 2442
   decision Engaged
   decision-altitude 600GOAL69 DIAL DIAL T Ignore-Autopilot
PROCEDURAL   83.872 SubGoal checking Altitude
VISUAL   84.850 altitude Value 2410
**Goal73    5.051
   isa CHECK-ALTITUDE
   altitude 2410
   previous 2500GOAL73 DIAL DIAL T Ignore-Altitude
PROCEDURAL   85.508 SubGoal checking Speed Brakes
VISUAL   86.427 speed Value 169
VISUAL   87.598 airbrakes Value off
**Goal75    8.147
   isa SPEED-BRAKES
   speed 169
   decision OffGOAL75 DIAL DIAL T Decide-Speed-Brakes
PROCEDURAL   88.198 SubGoal setting Dial Altitude
VISUAL   89.317 waypoint Value 3
RETRIEVAL   89.467 Altitude 1000
VISUAL   90.408 dial-altitude Value 1800
MANUAL   92.510 dial-altitude set 1000
**Goal78    4.857
   isa DIAL-ALTITUDE
   waypoint 3
   altitude 1000GOAL78 DIAL DIAL T Dial-Altitude
PROCEDURAL   93.117 SubGoal checking Landing Gear
VISUAL   94.209 waypoint Value 3
VISUAL   95.089 distance-next Value 1
RETRIEVAL   95.189 Waypoint 3 Next 1 Distance 10
VISUAL   96.254 landing-gear Value down
**Goal82    8.106
   isa MOVE-GEAR
   waypoint 3
   distance-next 1
   distance 10
   decision DownGOAL82 DIAL DIAL T Decide-Gear
PROCEDURAL   96.854 SubGoal checking Flaps
VISUAL   97.994 speed Value 165
RETRIEVAL   98.144 Flaps 15
VISUAL   99.358 flaps Value 1
MANUAL  102.509 flaps set 15
**Goal86    4.779
   isa SET-FLAP
   speed 165
   flap 15GOAL86 DIAL DIAL T Set-Flaps
PROCEDURAL  103.115 SubGoal checking Decision Altitude
VISUAL  104.187 waypoint Value 3
VISUAL  105.504 distance-next Value 1
RETRIEVAL  105.604 Waypoint 3 Next 1 Distance 10
```

```
**Goal90    5.364
   isa SET-DECISION-ALTITUDE
   waypoint 3
   distance-next 1
   distance 10
   old 600
   decision 600GOAL90 DIAL DIAL T Ignore-Decision-Altitude
PROCEDURAL  106.260 SubGoal checking Altitude
VISUAL  107.262 altitude Value 1994
**Goal93    4.903
   isa CHECK-ALTITUDE
   altitude 1994
   previous 2410GOAL93 DIAL DIAL T Read-Altitude
PROCEDURAL  107.919 SubGoal checking Autopilot
VISUAL  108.828 otw_runway Value out-of-sight
VISUAL  110.050 autopilots Value up
VISUAL  111.347 altitude Value 1919
**Goal95    8.263
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1919
   decision Engaged
   decision-altitude 600GOAL95 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  112.048 SubGoal checking Altitude
VISUAL  112.896 altitude Value 1891
**Goal99    4.882
   isa CHECK-ALTITUDE
   altitude 1891
   previous 1994GOAL99 DIAL DIAL T Ignore-Altitude
PROCEDURAL  113.552 SubGoal setting Dial Altitude
VISUAL  114.746 waypoint Value 3
RETRIEVAL  114.896 Altitude 1000
VISUAL  115.653 dial-altitude Value 1000
PROCEDURAL  115.703 Confirm Altitude already set to 1000
**Goal101    5.047
   isa DIAL-ALTITUDE
   waypoint 3
   altitude 1000GOAL101 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  116.310 SubGoal checking Altitude
VISUAL  117.150 altitude Value 1812
**Goal104    5.149
   isa CHECK-ALTITUDE
   altitude 1812
   previous 1891GOAL104 DIAL DIAL T Ignore-Altitude
PROCEDURAL  117.806 SubGoal checking Autopilot
VISUAL  119.000 otw_runway Value out-of-sight
VISUAL  120.006 autopilots Value up
VISUAL  121.030 altitude Value 1778
**Goal106    8.190
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1778
   decision Engaged
   decision-altitude 600GOAL106 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  121.732 SubGoal checking Altitude
VISUAL  122.607 altitude Value 1767
**Goal110    5.361
```

```
   isa CHECK-ALTITUDE
   altitude 1767
   previous 1812GOAL110 DIAL DIAL T Ignore-Altitude
PROCEDURAL  123.265 SubGoal setting Dial Altitude
VISUAL  124.445 waypoint Value 4
RETRIEVAL  124.595 Altitude 700
VISUAL  125.565 dial-altitude Value 1000
MANUAL  128.427 dial-altitude set 700
**Goal112    4.829
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL112 DIAL DIAL T Dial-Altitude
PROCEDURAL  129.035 SubGoal completing landing checklist
PROCEDURAL  132.137 Landing checklist: setting Gear down 1
MANUAL  132.137 landing-gear up/down 0
PROCEDURAL  134.533 Landing checklist: preparing cabin for landing
VOCAL  134.533 nothing communication 2007
PROCEDURAL  136.780 Landing checklist: setting Speed to 135
MANUAL  136.780 speed set 135
VISUAL  136.780 speed Value 165
CHUNK NIL IS UNDEFINED.
CHUNK NIL IS UNDEFINED.
PROCEDURAL  139.627 Landing checklist: setting Flaps 15
MANUAL  139.627 flaps set 15
PROCEDURAL  143.462 Landing checklist: setting Speed-brakes to armed
MANUAL  143.462 airbrakes on/off 0
VOCAL  143.512 Landing Checklist Complete
PROCEDURAL  143.671 SubGoal checking Altitude
VISUAL  144.734 altitude Value 1611
**Goal123    5.038
   isa CHECK-ALTITUDE
   altitude 1611
   previous 1767GOAL123 DIAL DIAL T Read-Altitude
PROCEDURAL  145.391 SubGoal checking Autopilot
VISUAL  146.300 otw_runway Value out-of-sight
VISUAL  147.562 autopilots Value up
VISUAL  148.747 altitude Value 1583
**Goal125    8.019
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1583
   decision Engaged
   decision-altitude 600GOAL125 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  149.448 SubGoal checking Altitude
VISUAL  150.533 altitude Value 1570
**Goal129    4.992
   isa CHECK-ALTITUDE
   altitude 1570
   previous 1611GOAL129 DIAL DIAL T Ignore-Altitude
PROCEDURAL  151.191 SubGoal setting Dial Altitude
VISUAL  151.996 waypoint Value 4
RETRIEVAL  152.146 Altitude 700
VISUAL  153.170 dial-altitude Value 700
PROCEDURAL  153.220 Confirm Altitude already set to 700
**Goal131    4.996
   isa DIAL-ALTITUDE
   waypoint 4
```

```
   altitude 700GOAL131 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  153.825 SubGoal checking Altitude
VISUAL  154.815 altitude Value 1540
**Goal134    5.215
   isa CHECK-ALTITUDE
   altitude 1540
   previous 1570GOAL134 DIAL DIAL T Ignore-Altitude
PROCEDURAL  155.471 SubGoal checking Autopilot
VISUAL  156.295 otw_runway Value out-of-sight
VISUAL  157.367 autopilots Value up
VISUAL  158.418 atc Value random-listen
VISUAL  158.418 altitude Value 1515
**Goal136    7.864
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1515
   decision Engaged
   decision-altitude 600GOAL136 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  159.119 SubGoal checking Altitude
VISUAL  160.174 altitude Value 1502
**Goal140    4.361
   isa CHECK-ALTITUDE
   altitude 1502
   previous 1540GOAL140 DIAL DIAL T Ignore-Altitude
PROCEDURAL  160.831 SubGoal setting Dial Altitude
VISUAL  161.676 waypoint Value 4
RETRIEVAL  161.826 Altitude 700
VISUAL  162.891 dial-altitude Value 700
PROCEDURAL  162.941 Confirm Altitude already set to 700
**Goal142    4.863
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL142 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  163.547 SubGoal checking Altitude
VISUAL  164.377 altitude Value 1473
**Goal145    4.760
   isa CHECK-ALTITUDE
   altitude 1473
   previous 1502GOAL145 DIAL DIAL T Ignore-Altitude
PROCEDURAL  165.036 SubGoal checking Autopilot
VISUAL  165.861 otw_runway Value out-of-sight
VISUAL  166.827 autopilots Value up
VISUAL  167.784 altitude Value 1449
**Goal147    8.035
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1449
   decision Engaged
   decision-altitude 600GOAL147 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  168.485 SubGoal checking Altitude
VISUAL  169.508 altitude Value 1437
**Goal151    5.119
   isa CHECK-ALTITUDE
   altitude 1437
   previous 1473GOAL151 DIAL DIAL T Ignore-Altitude
PROCEDURAL  170.163 SubGoal checking Autopilot
VISUAL  171.024 otw_runway Value out-of-sight
```

```
VISUAL  171.927 autopilots Value up
VISUAL  172.871 altitude Value 1413
**Goal153    7.803
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1413
   decision Engaged
   decision-altitude 600GOAL153 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  173.572 SubGoal checking Altitude
VISUAL  174.758 altitude Value 1400
**Goal157    4.922
   isa CHECK-ALTITUDE
   altitude 1400
   previous 1437GOAL157 DIAL DIAL T Ignore-Altitude
PROCEDURAL  175.416 SubGoal setting Dial Altitude
VISUAL  176.688 waypoint Value 4
RETRIEVAL  176.838 Altitude 700
VISUAL  177.932 dial-altitude Value 700
PROCEDURAL  177.982 Confirm Altitude already set to 700
**Goal159    4.764
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL159 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  178.589 SubGoal checking Altitude
VISUAL  179.760 altitude Value 1364
**Goal162    4.836
   isa CHECK-ALTITUDE
   altitude 1364
   previous 1400GOAL162 DIAL DIAL T Ignore-Altitude
PROCEDURAL  180.416 SubGoal setting Dial Altitude
VISUAL  181.445 waypoint Value 4
RETRIEVAL  181.595 Altitude 700
VISUAL  182.608 dial-altitude Value 700
PROCEDURAL  182.658 Confirm Altitude already set to 700
**Goal164    4.861
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL164 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  183.264 SubGoal checking Altitude
VISUAL  184.251 altitude Value 1333
**Goal167    4.822
   isa CHECK-ALTITUDE
   altitude 1333
   previous 1364GOAL167 DIAL DIAL T Ignore-Altitude
PROCEDURAL  184.907 SubGoal setting Dial Altitude
VISUAL  186.067 waypoint Value 4
RETRIEVAL  186.218 Altitude 700
VISUAL  187.410 dial-altitude Value 700
PROCEDURAL  187.460 Confirm Altitude already set to 700
**Goal169    4.865
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL169 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  188.067 SubGoal checking Altitude
VISUAL  188.879 altitude Value 1300
**Goal172    4.706
   isa CHECK-ALTITUDE
```

```
   altitude 1300
   previous 1333GOAL172 DIAL DIAL T Ignore-Altitude
PROCEDURAL  189.535 SubGoal setting Dial Altitude
VISUAL  190.408 waypoint Value 4
RETRIEVAL  190.559 Altitude 700
VISUAL  191.351 dial-altitude Value 700
PROCEDURAL  191.401 Confirm Altitude already set to 700
**Goal174    4.868
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL174 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  192.007 SubGoal checking Altitude
VISUAL  193.041 altitude Value 1271
**Goal177    4.793
   isa CHECK-ALTITUDE
   altitude 1271
   previous 1300GOAL177 DIAL DIAL T Ignore-Altitude
PROCEDURAL  193.698 SubGoal checking Autopilot
VISUAL  194.862 otw_runway Value out-of-sight
VISUAL  195.928 autopilots Value up
VISUAL  197.105 altitude Value 1243
**Goal179    7.970
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1243
   decision Engaged
   decision-altitude 600GOAL179 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  197.807 SubGoal checking Altitude
VISUAL  198.970 altitude Value 1229
**Goal183    4.915
   isa CHECK-ALTITUDE
   altitude 1229
   previous 1271GOAL183 DIAL DIAL T Ignore-Altitude
PROCEDURAL  199.628 SubGoal setting Dial Altitude
VISUAL  200.859 waypoint Value 4
RETRIEVAL  201.009 Altitude 700
VISUAL  201.839 dial-altitude Value 700
PROCEDURAL  201.889 Confirm Altitude already set to 700
**Goal185    4.874
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL185 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  202.496 SubGoal checking Altitude
VISUAL  203.603 altitude Value 1197
**Goal188    5.124
   isa CHECK-ALTITUDE
   altitude 1197
   previous 1229GOAL188 DIAL DIAL T Ignore-Altitude
PROCEDURAL  204.260 SubGoal setting Dial Altitude
VISUAL  205.481 waypoint Value 4
RETRIEVAL  205.631 Altitude 700
VISUAL  206.492 dial-altitude Value 700
PROCEDURAL  206.542 Confirm Altitude already set to 700
**Goal190    4.977
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL190 DIAL DIAL T Dial-Altitude-Already-Dialed
```

```
PROCEDURAL  207.150 SubGoal checking Altitude
VISUAL  208.370 altitude Value 1163
**Goal193    4.860
   isa CHECK-ALTITUDE
   altitude 1163
   previous 1197GOAL193 DIAL DIAL T Ignore-Altitude
PROCEDURAL  209.025 SubGoal setting Dial Altitude
VISUAL  210.077 waypoint Value 4
RETRIEVAL  210.227 Altitude 700
VISUAL  211.109 dial-altitude Value 700
PROCEDURAL  211.159 Confirm Altitude already set to 700
**Goal195    4.980
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL195 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  211.766 SubGoal checking Altitude
VISUAL  213.025 altitude Value 1131
**Goal198    4.994
   isa CHECK-ALTITUDE
   altitude 1131
   previous 1163GOAL198 DIAL DIAL T Ignore-Altitude
PROCEDURAL  213.684 SubGoal setting Dial Altitude
VISUAL  214.889 waypoint Value 4
RETRIEVAL  215.040 Altitude 700
VISUAL  216.064 dial-altitude Value 700
PROCEDURAL  216.114 Confirm Altitude already set to 700
**Goal200    4.979
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL200 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  216.720 SubGoal checking Altitude
VISUAL  217.567 altitude Value 1098
**Goal203    4.993
   isa CHECK-ALTITUDE
   altitude 1098
   previous 1131GOAL203 DIAL DIAL T Ignore-Altitude
PROCEDURAL  218.227 SubGoal checking Autopilot
VISUAL  219.037 otw_runway Value out-of-sight
VISUAL  219.978 autopilots Value up
VISUAL  221.246 altitude Value 1072
**Goal205    7.672
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1072
   decision Engaged
   decision-altitude 600GOAL205 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  221.948 SubGoal checking Altitude
VISUAL  222.790 altitude Value 1062
**Goal209    4.726
   isa CHECK-ALTITUDE
   altitude 1062
   previous 1098GOAL209 DIAL DIAL T Ignore-Altitude
PROCEDURAL  223.446 SubGoal setting Dial Altitude
VISUAL  224.558 waypoint Value 4
RETRIEVAL  224.708 Altitude 700
VISUAL  225.481 dial-altitude Value 700
PROCEDURAL  225.531 Confirm Altitude already set to 700
```

```
**Goal211    4.915
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL211 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  226.138 SubGoal checking Altitude
VISUAL  227.177 altitude Value 1031
**Goal214    5.057
   isa CHECK-ALTITUDE
   altitude 1031
   previous 1062GOAL214 DIAL DIAL T Ignore-Altitude
PROCEDURAL  227.834 SubGoal checking Autopilot
VISUAL  228.924 otw_runway Value out-of-sight
VISUAL  229.977 autopilots Value up
VISUAL  231.061 altitude Value 1003
**Goal216    7.876
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1003
   decision Engaged
   decision-altitude 600GOAL216 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  231.762 SubGoal checking Altitude
VISUAL  232.753 altitude Value 980
**Goal220    4.848
   isa CHECK-ALTITUDE
   altitude 980
   previous 1031GOAL220 DIAL DIAL T Ignore-Altitude
PROCEDURAL  233.407 SubGoal setting Dial Altitude
VISUAL  234.611 waypoint Value 5
RETRIEVAL  234.761 Altitude 500
VISUAL  235.762 dial-altitude Value 700
MANUAL  238.126 dial-altitude set 500
**Goal222    4.631
   isa DIAL-ALTITUDE
   waypoint 5
   altitude 500GOAL222 DIAL DIAL T Dial-Altitude
PROCEDURAL  238.732 SubGoal checking Altitude
VISUAL  239.805 atc Value random-no-listen
VISUAL  239.805 altitude Value 869
**Goal226    5.307
   isa CHECK-ALTITUDE
   altitude 869
   previous 980GOAL226 DIAL DIAL T Ignore-Altitude
PROCEDURAL  240.462 SubGoal setting Dial Altitude
VISUAL  241.540 waypoint Value 5
RETRIEVAL  241.690 Altitude 500
VISUAL  242.896 dial-altitude Value 500
PROCEDURAL  242.946 Confirm Altitude already set to 500
**Goal228    4.871
   isa DIAL-ALTITUDE
   waypoint 5
   altitude 500GOAL228 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  243.553 SubGoal checking Altitude
VISUAL  244.442 altitude Value 797
**Goal231    5.069
   isa CHECK-ALTITUDE
   altitude 797
   previous 869GOAL231 DIAL DIAL T Ignore-Altitude
```

```
 PROCEDURAL  245.099 SubGoal setting Dial Altitude
 VISUAL  246.331 waypoint Value 5
 RETRIEVAL  246.481 Altitude 500
 VISUAL  247.432 dial-altitude Value 500
 PROCEDURAL  247.482 Confirm Altitude already set to 500
 **Goal233    4.956
    isa DIAL-ALTITUDE
    waypoint 5
    altitude 500GOAL233 DIAL DIAL T Dial-Altitude-Already-Dialed
 PROCEDURAL  248.091 SubGoal checking Altitude
 VISUAL  249.351 altitude Value 718
 **Goal236    4.687
    isa CHECK-ALTITUDE
    altitude 718
    previous 797GOAL236 DIAL DIAL T Ignore-Altitude
 PROCEDURAL  250.008 SubGoal checking Autopilot
 VISUAL  250.881 otw_runway Value out-of-sight
 VISUAL  251.728 autopilots Value up
 VISUAL  252.549 altitude Value 644
 **Goal238    7.649
    isa SET-AUTOPILOT
    visibility Out-Of-Sight
    peek 644
    decision Engaged
    decision-altitude 600GOAL238 DIAL DIAL T Ignore-Autopilot
 PROCEDURAL  253.250 SubGoal checking Altitude
 VISUAL  254.071 altitude Value 608
 **Goal242    5.011
    isa CHECK-ALTITUDE
    altitude 608
    previous 718GOAL242 DIAL DIAL T Ignore-Altitude
 PROCEDURAL  254.727 SubGoal checking Autopilot
 VISUAL  255.550 otw_runway Value runway-off-alignment
 VISUAL  256.584 autopilots Value up
 PROCEDURAL  256.634 Runway misaligned -- going around
 MANUAL  258.642 autopilots up/down 0
 VISUAL  259.935 altitude Value 550
 **Goal244   10.048
    isa SET-AUTOPILOT
    visibility Runway-Off-Alignment
    peek Looking
    decision Disengaged
    decision-altitude 600GOAL244 DIAL DIAL T Peek


*** Finis  ***


*** Setting ModelDone to 1***

 MCP NAV PFD SVS CONTROLS OTW off Total-time
 25.309576 97.08623 78.63479 0 18.429737 20.286167 20.73816 260.48465
EMC End:T 260.48465

Look 1.0 Action 2.5 Listen 0.5 Ans 0.1
```

```
;; Factory is idle.
```

7-SVS IMC Vectored approach

```
dribbling to file "NASA-hpm-model-results.drb"

; Fast loading
;    C:\Documents and Settings\bbest\My Documents\Completed
Projects\NASA HEM\NasaHEMv07-Jul-
2005\nasav07\HPMv7\delivery\ole\client\autotool.fasl
;   Fast loading
;      C:\Documents and Settings\bbest\My Documents\Completed
Projects\NASA HEM\NasaHEMv07-Jul-
2005\nasav07\HPMv7\delivery\ole\client\idispatch.fasl
;   Fast loading
;      C:\Documents and Settings\bbest\My Documents\Completed
Projects\NASA HEM\NasaHEMv07-Jul-
2005\nasav07\HPMv7\delivery\ole\client\iclassfactory.fasl

Factory Started
CL-USER(1): (register-server)
Resistered Server EMC_NASAHPM.EMCReceiveCOMMessages
NIL
CL-USER(2):
Subject 0 Trial 0 Run 1
Initializing control

 Control    4.817
    isa CONTROL
    speed 200.0d0
    altitude 2500.0d0
    waypoint nil
    distance nil
    flaps 5
    decision-altitude 600
    landing-gear Up
    airbrakes Off
    autopilots Engaged
    task nil
    last-task nil
    status Active
    landing-checklist nil
 VISUAL    0.000 flaps Value 5
 CHUNK NIL IS UNDEFINED.
 CHUNK NIL IS UNDEFINED.
 PROCEDURAL    0.937 Preparing for approach: engaging Autopilot
 VISUAL    0.937 autopilots Value up
 PROCEDURAL    2.885 Preparing for approach: setting Flaps 1
 MANUAL    2.885 flaps set 1
 PROCEDURAL    3.794 Preparing for approach: setting LNAV
 VISUAL    3.794 distance-next Value 1
 PROCEDURAL    7.475 Preparing for approach: engaging Speed-brakes full
 MANUAL    7.475 airbrakes on/off 0
 PROCEDURAL    8.594 Preparing for approach: setting VNAV
 VISUAL    8.594 waypoint Value 1
 PROCEDURAL    8.751 SubGoal checking Altitude
 VISUAL    9.856 altitude Value 2500
 **Goal6    4.763
```

```
   isa CHECK-ALTITUDE
   altitude 2500
   previous 2500.0d0GOAL6 NIL NIL T Ignore-Altitude
PROCEDURAL   10.512 SubGoal checking Autopilot
VISUAL   11.809 otw_runway Value out-of-sight
VISUAL   12.858 autopilots Value up
VISUAL   13.786 altitude Value 2500
**Goal8    8.422
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 2500
   decision Engaged
   decision-altitude 600GOAL8 NIL NIL T Ignore-Autopilot
PROCEDURAL   14.487 SubGoal setting Dial Altitude
VISUAL   15.349 waypoint Value 1
RETRIEVAL   15.549 Altitude 2500
VISUAL   16.623 dial-altitude Value 2500
PROCEDURAL   16.673 Confirm Altitude already set to 2500
**Goal12    4.862
   isa DIAL-ALTITUDE
   waypoint 1
   altitude 2500GOAL12 DIAL NIL NIL Dial-Altitude-Already-Dialed
PROCEDURAL   18.279 SubGoal checking Decision Altitude
VISUAL   19.275 waypoint Value 2
VISUAL   20.525 distance-next Value 4
RETRIEVAL   20.625 Waypoint 2 Next 4 Distance 15
**Goal15    5.119
   isa SET-DECISION-ALTITUDE
   waypoint 2
   distance-next 4
   distance 15
   old 600
   decision 600GOAL15 DIAL DIAL T Ignore-Decision-Altitude
PROCEDURAL   21.281 SubGoal checking Landing Gear
VISUAL   22.176 waypoint Value 2
VISUAL   23.143 distance-next Value 4
RETRIEVAL   23.243 Waypoint 2 Next 4 Distance 15
VISUAL   24.308 landing-gear Value up
PROCEDURAL   24.358 Lowering Gear
MANUAL   26.324 landing-gear up/down 0
**Goal18    8.931
   isa MOVE-GEAR
   waypoint 2
   distance-next 4
   distance 15
   decision DownGOAL18 DIAL DIAL T Move-Gear
PROCEDURAL   26.931 SubGoal checking Speed
VISUAL   27.969 waypoint Value 2
VISUAL   29.080 distance-next Value 3
RETRIEVAL   29.180 Waypoint 2 Next 3 Distance 14
RETRIEVAL   29.330 Speed
VISUAL   30.565 dial-speed Value 200
MANUAL   33.436 dial-speed set 165
**Goal23    4.981
   isa SET-SPEED
   waypoint 2
   distance-next 3
```

```
   distance 14
   speed 165GOAL23 DIAL DIAL T Dial-Speed
PROCEDURAL   34.045 SubGoal checking Flaps
VISUAL   35.206 speed Value 199
RETRIEVAL   35.406 Flaps 15
VISUAL   36.594 flaps Value 1
MANUAL   39.607 flaps set 15
**Goal28    5.196
   isa SET-FLAP
   speed 199
   flap 15GOAL28 DIAL DIAL T Set-Flaps
PROCEDURAL   40.215 SubGoal checking Speed Brakes
VISUAL   41.111 speed Value 194
VISUAL   42.130 airbrakes Value on
PROCEDURAL   42.180 Setting Speed Brakes
MANUAL   44.421 airbrakes on/off 0
**Goal32    8.776
   isa SPEED-BRAKES
   speed 194
   decision OffGOAL32 DIAL DIAL T Set-Speed-Brakes
PROCEDURAL   45.021 SubGoal checking Altitude
VISUAL   45.845 altitude Value 2500
**Goal36    4.990
   isa CHECK-ALTITUDE
   altitude 2500
   previous 2500GOAL36 DIAL DIAL T Ignore-Altitude
PROCEDURAL   46.503 SubGoal checking Decision Altitude
VISUAL   47.327 waypoint Value 2
VISUAL   48.245 distance-next Value 2
RETRIEVAL   48.345 Waypoint 2 Next 2 Distance 13
**Goal38    4.989
   isa SET-DECISION-ALTITUDE
   waypoint 2
   distance-next 2
   distance 13
   old 600
   decision 600GOAL38 DIAL DIAL T Ignore-Decision-Altitude
PROCEDURAL   49.001 SubGoal checking Autopilot
VISUAL   50.042 otw_runway Value out-of-sight
VISUAL   50.923 autopilots Value up
VISUAL   51.996 altitude Value 2500
**Goal41    8.483
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 2500
   decision Engaged
   decision-altitude 600GOAL41 DIAL DIAL T Ignore-Autopilot
PROCEDURAL   52.697 SubGoal setting Dial Altitude
VISUAL   53.709 waypoint Value 2
RETRIEVAL   53.859 Altitude 1800
VISUAL   55.099 dial-altitude Value 2500
MANUAL   57.748 dial-altitude set 1800
**Goal45    5.065
   isa DIAL-ALTITUDE
   waypoint 2
   altitude 1800GOAL45 DIAL DIAL T Dial-Altitude
PROCEDURAL   58.355 SubGoal checking Landing Gear
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VISUAL   59.366 waypoint Value 2
VISUAL   60.481 distance-next Value 1
RETRIEVAL   60.581 Waypoint 2 Next 1 Distance 12
VISUAL   61.535 landing-gear Value down
**Goal49    8.563
   isa MOVE-GEAR
   waypoint 2
   distance-next 1
   distance 12
   decision DownGOAL49 DIAL DIAL T Decide-Gear
PROCEDURAL   62.135 SubGoal checking Flaps
VISUAL   63.178 speed Value 176
RETRIEVAL   63.329 Flaps 25
VISUAL   64.454 flaps Value 15
MANUAL   67.021 flaps set 25
**Goal53    4.961
   isa SET-FLAP
   speed 176
   flap 25GOAL53 DIAL DIAL T Set-Flaps
PROCEDURAL   67.628 SubGoal checking Altitude
VISUAL   68.818 altitude Value 2500
**Goal57    4.806
   isa CHECK-ALTITUDE
   altitude 2500
   previous 2500GOAL57 DIAL DIAL T Ignore-Altitude
PROCEDURAL   69.476 SubGoal checking Speed Brakes
VISUAL   70.594 speed Value 170
VISUAL   71.575 airbrakes Value off
**Goal59    8.689
   isa SPEED-BRAKES
   speed 170
   decision OffGOAL59 DIAL DIAL T Decide-Speed-Brakes
PROCEDURAL   72.175 SubGoal checking Speed
VISUAL   73.169 waypoint Value 2
VISUAL   74.265 distance-next Value 0
RETRIEVAL   74.365 Waypoint 2 Next 0 Distance 11
RETRIEVAL   74.465 Speed
VISUAL   75.399 dial-speed Value 165
MANUAL   77.470 dial-speed set 140
**Goal62    5.166
   isa SET-SPEED
   waypoint 2
   distance-next 0
   distance 11
   speed 140GOAL62 DIAL DIAL T Dial-Speed
PROCEDURAL   78.077 SubGoal checking Decision Altitude
VISUAL   79.284 waypoint Value 2
VISUAL   80.565 atc Value random-listen
VISUAL   80.565 distance-next Value 0
RETRIEVAL   80.665 Waypoint 2 Next 0 Distance 11
**Goal67    4.580
   isa SET-DECISION-ALTITUDE
   waypoint 2
   distance-next 0
   distance 11
   old 600
   decision 600GOAL67 DIAL DIAL T Ignore-Decision-Altitude
```

```
PROCEDURAL   81.321 SubGoal checking Autopilot
VISUAL   82.191 otw_runway Value out-of-sight
VISUAL   83.302 atc Value ten-miles-out
VISUAL   83.302 autopilots Value up
VISUAL   84.280 altitude Value 2477
**Goal70    8.925
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 2477
   decision Engaged
   decision-altitude 600GOAL70 DIAL DIAL T Ignore-Autopilot
PROCEDURAL   84.980 SubGoal checking Speed Brakes
VISUAL   85.952 speed Value 159
VISUAL   87.272 airbrakes Value off
**Goal74    8.590
   isa SPEED-BRAKES
   speed 159
   decision OffGOAL74 DIAL DIAL T Decide-Speed-Brakes
PROCEDURAL   87.872 SubGoal setting Dial Altitude
VISUAL   89.008 waypoint Value 3
RETRIEVAL   89.158 Altitude 1000
VISUAL   90.099 dial-altitude Value 1800
MANUAL   92.152 dial-altitude set 1000
**Goal77    5.174
   isa DIAL-ALTITUDE
   waypoint 3
   altitude 1000GOAL77 DIAL DIAL T Dial-Altitude
PROCEDURAL   92.758 SubGoal checking Altitude
VISUAL   93.970 altitude Value 2305
**Goal81    5.066
   isa CHECK-ALTITUDE
   altitude 2305
   previous 2500GOAL81 DIAL DIAL T Read-Altitude
PROCEDURAL   94.626 SubGoal checking Landing Gear
VISUAL   95.429 waypoint Value 3
VISUAL   96.775 distance-next Value 1
RETRIEVAL   96.875 Waypoint 3 Next 1 Distance 10
VISUAL   97.854 landing-gear Value down
**Goal83    8.559
   isa MOVE-GEAR
   waypoint 3
   distance-next 1
   distance 10
   decision DownGOAL83 DIAL DIAL T Decide-Gear
PROCEDURAL   98.454 SubGoal checking Decision Altitude
VISUAL   99.427 waypoint Value 3
VISUAL  100.559 distance-next Value 1
RETRIEVAL  100.659 Waypoint 3 Next 1 Distance 10
**Goal87    4.876
   isa SET-DECISION-ALTITUDE
   waypoint 3
   distance-next 1
   distance 10
   old 600
   decision 600GOAL87 DIAL DIAL T Ignore-Decision-Altitude
PROCEDURAL  101.315 SubGoal checking Flaps
VISUAL  102.496 speed Value 156
```

```
RETRIEVAL  102.646 Flaps 20
VISUAL  103.841 flaps Value 25
MANUAL  106.658 flaps set 20
**Goal90    4.789
   isa SET-FLAP
   speed 156
   flap 20GOAL90 DIAL DIAL T Set-Flaps
PROCEDURAL  107.263 SubGoal checking Speed Brakes
VISUAL  108.242 speed Value 155
VISUAL  109.290 airbrakes Value off
**Goal94    8.079
   isa SPEED-BRAKES
   speed 155
   decision OffGOAL94 DIAL DIAL T Decide-Speed-Brakes
PROCEDURAL  109.890 SubGoal checking Altitude
VISUAL  110.953 altitude Value 2008
**Goal97    4.854
   isa CHECK-ALTITUDE
   altitude 2008
   previous 2305GOAL97 DIAL DIAL T Read-Altitude
PROCEDURAL  111.610 SubGoal checking Autopilot
VISUAL  112.522 otw_runway Value out-of-sight
VISUAL  113.715 autopilots Value up
VISUAL  114.764 altitude Value 1943
**Goal99    8.131
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1943
   decision Engaged
   decision-altitude 600GOAL99 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  115.465 SubGoal checking Decision Altitude
VISUAL  116.278 waypoint Value 3
VISUAL  117.200 distance-next Value 0
RETRIEVAL  117.300 Waypoint 3 Next 0 Distance 9
**Goal103    5.029
   isa SET-DECISION-ALTITUDE
   waypoint 3
   distance-next 0
   distance 9
   old 600
   decision 600GOAL103 DIAL DIAL T Ignore-Decision-Altitude
PROCEDURAL  117.957 SubGoal checking Speed
VISUAL  119.162 waypoint Value 3
VISUAL  120.118 distance-next Value 0
RETRIEVAL  120.218 Waypoint 3 Next 0 Distance 9
RETRIEVAL  120.319 Speed
VISUAL  121.107 dial-speed Value 140
PROCEDURAL  121.157 Confirm Speed already set to 140
**Goal106    4.793
   isa SET-SPEED
   waypoint 3
   distance-next 0
   distance 9
   speed 140GOAL106 DIAL DIAL T Speed-Already-Dialed
PROCEDURAL  121.764 SubGoal checking Altitude
VISUAL  122.870 altitude Value 1805
**Goal110    4.899
```

```
   isa CHECK-ALTITUDE
   altitude 1805
   previous 2008GOAL110 DIAL DIAL T Read-Altitude
PROCEDURAL  123.526 SubGoal setting Dial Altitude
VISUAL  124.747 waypoint Value 4
RETRIEVAL  124.897 Altitude 700
VISUAL  125.726 dial-altitude Value 1000
MANUAL  128.003 dial-altitude set 700
**Goal112    5.111
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL112 DIAL DIAL T Dial-Altitude
PROCEDURAL  128.609 SubGoal completing landing checklist
PROCEDURAL  131.424 Landing checklist: preparing cabin for landing
VOCAL  131.424 nothing communication 2007
PROCEDURAL  133.375 Landing checklist: setting Gear down 1
MANUAL  133.375 landing-gear up/down 0
PROCEDURAL  136.456 Landing checklist: setting Speed to 135
MANUAL  136.456 speed set 135
VISUAL  136.456 speed Value 148
CHUNK NIL IS UNDEFINED.
CHUNK NIL IS UNDEFINED.
PROCEDURAL  140.054 Landing checklist: setting Speed-brakes to armed
MANUAL  140.054 airbrakes on/off 0
PROCEDURAL  142.550 Landing checklist: setting Flaps 15
MANUAL  142.550 flaps set 15
VOCAL  142.600 Landing Checklist Complete
PROCEDURAL  142.758 SubGoal checking Autopilot
VISUAL  143.783 otw_runway Value out-of-sight
VISUAL  144.754 autopilots Value up
VISUAL  145.891 altitude Value 1656
**Goal123    8.501
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1656
   decision Engaged
   decision-altitude 600GOAL123 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  146.592 SubGoal checking Altitude
VISUAL  147.644 altitude Value 1645
**Goal127    5.171
   isa CHECK-ALTITUDE
   altitude 1645
   previous 1805GOAL127 DIAL DIAL T Read-Altitude
PROCEDURAL  148.299 SubGoal setting Dial Altitude
VISUAL  149.199 waypoint Value 4
RETRIEVAL  149.349 Altitude 700
VISUAL  150.255 dial-altitude Value 700
PROCEDURAL  150.305 Confirm Altitude already set to 700
**Goal129    4.938
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL129 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  150.912 SubGoal checking Altitude
VISUAL  151.813 altitude Value 1619
**Goal132    4.845
   isa CHECK-ALTITUDE
   altitude 1619
```

```
   previous 1645GOAL132 DIAL DIAL T Ignore-Altitude
PROCEDURAL  152.470 SubGoal checking Autopilot
VISUAL  153.458 otw_runway Value out-of-sight
VISUAL  154.301 autopilots Value up
VISUAL  155.579 altitude Value 1596
**Goal134    8.105
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1596
   decision Engaged
   decision-altitude 600GOAL134 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  156.279 SubGoal checking Altitude
VISUAL  157.202 altitude Value 1586
**Goal138    4.784
   isa CHECK-ALTITUDE
   altitude 1586
   previous 1619GOAL138 DIAL DIAL T Ignore-Altitude
PROCEDURAL  157.860 SubGoal setting Dial Altitude
VISUAL  158.722 atc Value random-listen
VISUAL  158.722 waypoint Value 4
RETRIEVAL  158.872 Altitude 700
VISUAL  159.786 dial-altitude Value 700
PROCEDURAL  159.836 Confirm Altitude already set to 700
**Goal140    5.274
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL140 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  160.443 SubGoal checking Altitude
VISUAL  161.710 altitude Value 1558
**Goal143    5.006
   isa CHECK-ALTITUDE
   altitude 1558
   previous 1586GOAL143 DIAL DIAL T Ignore-Altitude
PROCEDURAL  162.367 SubGoal setting Dial Altitude
VISUAL  163.226 waypoint Value 4
RETRIEVAL  163.376 Altitude 700
VISUAL  164.241 dial-altitude Value 700
PROCEDURAL  164.291 Confirm Altitude already set to 700
**Goal145    5.066
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL145 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  164.899 SubGoal checking Altitude
VISUAL  165.823 altitude Value 1533
**Goal148    4.958
   isa CHECK-ALTITUDE
   altitude 1533
   previous 1558GOAL148 DIAL DIAL T Ignore-Altitude
PROCEDURAL  166.482 SubGoal setting Dial Altitude
VISUAL  167.488 waypoint Value 4
RETRIEVAL  167.639 Altitude 700
VISUAL  168.463 dial-altitude Value 700
PROCEDURAL  168.513 Confirm Altitude already set to 700
**Goal150    4.956
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL150 DIAL DIAL T Dial-Altitude-Already-Dialed
```

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PROCEDURAL  169.119 SubGoal checking Altitude
VISUAL  169.928 altitude Value 1509
**Goal153    4.978
   isa CHECK-ALTITUDE
   altitude 1509
   previous 1533GOAL153 DIAL DIAL T Ignore-Altitude
PROCEDURAL  170.587 SubGoal checking Autopilot
VISUAL  171.563 otw_runway Value out-of-sight
VISUAL  172.826 autopilots Value up
VISUAL  173.723 altitude Value 1486
**Goal155    7.745
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1486
   decision Engaged
   decision-altitude 600GOAL155 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  174.425 SubGoal checking Altitude
VISUAL  175.602 altitude Value 1474
**Goal159    5.016
   isa CHECK-ALTITUDE
   altitude 1474
   previous 1509GOAL159 DIAL DIAL T Ignore-Altitude
PROCEDURAL  176.258 SubGoal checking Autopilot
VISUAL  177.437 otw_runway Value out-of-sight
VISUAL  178.667 autopilots Value up
VISUAL  179.749 altitude Value 1449
**Goal161    7.992
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1449
   decision Engaged
   decision-altitude 600GOAL161 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  180.450 SubGoal checking Altitude
VISUAL  181.617 altitude Value 1438
**Goal165    4.687
   isa CHECK-ALTITUDE
   altitude 1438
   previous 1474GOAL165 DIAL DIAL T Ignore-Altitude
PROCEDURAL  182.274 SubGoal setting Dial Altitude
VISUAL  183.424 waypoint Value 4
RETRIEVAL  183.574 Altitude 700
VISUAL  184.748 dial-altitude Value 700
PROCEDURAL  184.798 Confirm Altitude already set to 700
**Goal167    4.819
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL167 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  185.406 SubGoal checking Altitude
VISUAL  186.685 altitude Value 1408
**Goal170    5.295
   isa CHECK-ALTITUDE
   altitude 1408
   previous 1438GOAL170 DIAL DIAL T Ignore-Altitude
PROCEDURAL  187.341 SubGoal checking Autopilot
VISUAL  188.259 otw_runway Value out-of-sight
VISUAL  189.123 autopilots Value up
VISUAL  190.006 altitude Value 1388
```

```
**Goal172    8.056
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1388
   decision Engaged
   decision-altitude 600GOAL172 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  190.707 SubGoal checking Altitude
VISUAL  191.811 altitude Value 1377
**Goal176    5.009
   isa CHECK-ALTITUDE
   altitude 1377
   previous 1408GOAL176 DIAL DIAL T Ignore-Altitude
PROCEDURAL  192.469 SubGoal setting Dial Altitude
VISUAL  193.570 waypoint Value 4
RETRIEVAL  193.720 Altitude 700
VISUAL  194.499 dial-altitude Value 700
PROCEDURAL  194.549 Confirm Altitude already set to 700
**Goal178    4.836
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL178 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  195.158 SubGoal checking Altitude
VISUAL  196.440 altitude Value 1349
**Goal181    4.578
   isa CHECK-ALTITUDE
   altitude 1349
   previous 1377GOAL181 DIAL DIAL T Ignore-Altitude
PROCEDURAL  197.096 SubGoal setting Dial Altitude
VISUAL  198.384 waypoint Value 4
RETRIEVAL  198.534 Altitude 700
VISUAL  199.535 dial-altitude Value 700
PROCEDURAL  199.585 Confirm Altitude already set to 700
**Goal183    5.202
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL183 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  200.193 SubGoal checking Altitude
VISUAL  201.384 altitude Value 1320
**Goal186    4.944
   isa CHECK-ALTITUDE
   altitude 1320
   previous 1349GOAL186 DIAL DIAL T Ignore-Altitude
PROCEDURAL  202.041 SubGoal setting Dial Altitude
VISUAL  203.244 waypoint Value 4
RETRIEVAL  203.394 Altitude 700
VISUAL  204.264 dial-altitude Value 700
PROCEDURAL  204.314 Confirm Altitude already set to 700
**Goal188    4.911
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL188 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  204.922 SubGoal checking Altitude
VISUAL  206.201 altitude Value 1292
**Goal191    5.079
   isa CHECK-ALTITUDE
   altitude 1292
   previous 1320GOAL191 DIAL DIAL T Ignore-Altitude
```

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PROCEDURAL  206.857 SubGoal setting Dial Altitude
VISUAL  208.121 waypoint Value 4
RETRIEVAL  208.271 Altitude 700
VISUAL  209.292 dial-altitude Value 700
PROCEDURAL  209.342 Confirm Altitude already set to 700
**Goal193    4.963
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL193 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  209.949 SubGoal checking Altitude
VISUAL  211.217 altitude Value 1262
**Goal196    5.281
   isa CHECK-ALTITUDE
   altitude 1262
   previous 1292GOAL196 DIAL DIAL T Ignore-Altitude
PROCEDURAL  211.875 SubGoal setting Dial Altitude
VISUAL  213.162 waypoint Value 4
RETRIEVAL  213.312 Altitude 700
VISUAL  214.309 dial-altitude Value 700
PROCEDURAL  214.359 Confirm Altitude already set to 700
**Goal198    4.711
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL198 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  214.965 SubGoal checking Altitude
VISUAL  215.967 altitude Value 1233
**Goal201    4.938
   isa CHECK-ALTITUDE
   altitude 1233
   previous 1262GOAL201 DIAL DIAL T Ignore-Altitude
PROCEDURAL  216.624 SubGoal setting Dial Altitude
VISUAL  217.888 waypoint Value 4
RETRIEVAL  218.038 Altitude 700
VISUAL  219.260 dial-altitude Value 700
PROCEDURAL  219.310 Confirm Altitude already set to 700
**Goal203    4.932
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL203 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  219.917 SubGoal checking Altitude
VISUAL  221.012 altitude Value 1203
**Goal206    4.894
   isa CHECK-ALTITUDE
   altitude 1203
   previous 1233GOAL206 DIAL DIAL T Ignore-Altitude
PROCEDURAL  221.668 SubGoal checking Autopilot
VISUAL  222.768 otw_runway Value out-of-sight
VISUAL  223.882 autopilots Value up
VISUAL  224.759 altitude Value 1181
**Goal208    8.026
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1181
   decision Engaged
   decision-altitude 600GOAL208 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  225.460 SubGoal checking Altitude
VISUAL  226.461 altitude Value 1170
```

```
**Goal212    4.398
   isa CHECK-ALTITUDE
   altitude 1170
   previous 1203GOAL212 DIAL DIAL T Ignore-Altitude
PROCEDURAL  227.117 SubGoal checking Autopilot
VISUAL  227.994 otw_runway Value out-of-sight
VISUAL  229.149 autopilots Value up
VISUAL  230.227 altitude Value 1148
**Goal214    7.993
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1148
   decision Engaged
   decision-altitude 600GOAL214 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  230.929 SubGoal checking Altitude
VISUAL  231.828 altitude Value 1139
**Goal218    4.868
   isa CHECK-ALTITUDE
   altitude 1139
   previous 1170GOAL218 DIAL DIAL T Ignore-Altitude
PROCEDURAL  232.483 SubGoal setting Dial Altitude
VISUAL  233.774 waypoint Value 4
RETRIEVAL  233.974 Altitude 700
VISUAL  235.112 dial-altitude Value 700
PROCEDURAL  235.162 Confirm Altitude already set to 700
**Goal220    5.105
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL220 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  235.769 SubGoal checking Altitude
VISUAL  236.836 atc Value random-listen
VISUAL  236.836 altitude Value 1109
**Goal223    5.124
   isa CHECK-ALTITUDE
   altitude 1109
   previous 1139GOAL223 DIAL DIAL T Ignore-Altitude
PROCEDURAL  237.494 SubGoal checking Autopilot
VISUAL  238.630 otw_runway Value out-of-sight
VISUAL  239.453 autopilots Value up
VISUAL  240.508 altitude Value 1087
**Goal225    7.687
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1087
   decision Engaged
   decision-altitude 600GOAL225 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  241.209 SubGoal checking Altitude
VISUAL  242.152 altitude Value 1077
**Goal229    5.020
   isa CHECK-ALTITUDE
   altitude 1077
   previous 1109GOAL229 DIAL DIAL T Ignore-Altitude
PROCEDURAL  242.810 SubGoal setting Dial Altitude
VISUAL  243.711 waypoint Value 4
RETRIEVAL  243.861 Altitude 700
VISUAL  245.076 dial-altitude Value 700
PROCEDURAL  245.126 Confirm Altitude already set to 700
```

```
**Goal231    5.101
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL231 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  245.732 SubGoal checking Altitude
VISUAL  246.837 altitude Value 1049
**Goal234    4.833
   isa CHECK-ALTITUDE
   altitude 1049
   previous 1077GOAL234 DIAL DIAL T Ignore-Altitude
PROCEDURAL  247.493 SubGoal setting Dial Altitude
VISUAL  248.459 waypoint Value 4
RETRIEVAL  248.609 Altitude 700
VISUAL  249.506 dial-altitude Value 700
PROCEDURAL  249.556 Confirm Altitude already set to 700
**Goal236    5.039
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL236 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  250.163 SubGoal checking Altitude
VISUAL  251.198 altitude Value 1023
**Goal239    4.489
   isa CHECK-ALTITUDE
   altitude 1023
   previous 1049GOAL239 DIAL DIAL T Ignore-Altitude
PROCEDURAL  251.855 SubGoal checking Autopilot
VISUAL  252.713 otw_runway Value out-of-sight
VISUAL  253.888 autopilots Value up
VISUAL  255.093 altitude Value 999
**Goal241    7.856
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 999
   decision Engaged
   decision-altitude 600GOAL241 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  255.794 SubGoal checking Altitude
VISUAL  257.090 altitude Value 972
**Goal245    5.365
   isa CHECK-ALTITUDE
   altitude 972
   previous 1023GOAL245 DIAL DIAL T Ignore-Altitude
PROCEDURAL  257.745 SubGoal checking Autopilot
VISUAL  258.617 otw_runway Value out-of-sight
VISUAL  259.876 autopilots Value up
VISUAL  261.013 altitude Value 920
**Goal247    7.653
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 920
   decision Engaged
   decision-altitude 600GOAL247 DIAL DIAL T Ignore-Autopilot
PROCEDURAL  261.715 SubGoal checking Altitude
VISUAL  262.558 altitude Value 898
**Goal251    4.972
   isa CHECK-ALTITUDE
   altitude 898
   previous 972GOAL251 DIAL DIAL T Ignore-Altitude
```

```
 PROCEDURAL  263.214 SubGoal setting Dial Altitude
 VISUAL  264.320 waypoint Value 5
 RETRIEVAL  264.470 Altitude 500
 VISUAL  265.363 dial-altitude Value 700
 MANUAL  268.107 dial-altitude set 500
 **Goal253    5.135
    isa DIAL-ALTITUDE
    waypoint 5
    altitude 500GOAL253 DIAL DIAL T Dial-Altitude
 PROCEDURAL  268.714 SubGoal checking Altitude
 VISUAL  269.668 altitude Value 803
 **Goal257    5.000
    isa CHECK-ALTITUDE
    altitude 803
    previous 898GOAL257 DIAL DIAL T Ignore-Altitude
 PROCEDURAL  270.323 SubGoal checking Autopilot
 VISUAL  271.354 otw_runway Value in-sight
 VISUAL  272.515 autopilots Value up
 PROCEDURAL  272.565 Disengage Autopilot and land
 MANUAL  275.668 autopilots up/down 0
 **Goal259    9.786
    isa SET-AUTOPILOT
    visibility In-Sight
    peek nil
    decision Disengaged
    decision-altitude 600GOAL259 DIAL DIAL T Disengage-Autopilot


*** Finis  ***


*** Setting ModelDone to 1***

 MCP NAV PFD SVS CONTROLS OTW off Total-time
 26.735094 104.95264 82.22931 0 16.755093 18.946987 26.605118 276.22424
EMC End:T 276.22424

Look 1.0 Action 2.5 Listen 0.5 Ans 0.1


;; Factory is idle.
```

8-SVS IMC Late reassignment

```
dribbling to file "NASA-hpm-model-results.drb"

; Fast loading
;    C:\Documents and Settings\bbest\My Documents\Completed
Projects\NASA HEM\NasaHEMv07-Jul-
2005\nasav07\HPMv7\delivery\ole\client\autotool.fasl
;   Fast loading
;      C:\Documents and Settings\bbest\My Documents\Completed
Projects\NASA HEM\NasaHEMv07-Jul-
2005\nasav07\HPMv7\delivery\ole\client\idispatch.fasl
;   Fast loading
;      C:\Documents and Settings\bbest\My Documents\Completed
Projects\NASA HEM\NasaHEMv07-Jul-
2005\nasav07\HPMv7\delivery\ole\client\iclassfactory.fasl

Factory Started
CL-USER(1): (register-server)
Resistered Server EMC_NASAHPM.EMCReceiveCOMMessages
NIL
CL-USER(2):
Subject 0 Trial 0 Run 1
Initializing control

 Control    5.230
    isa CONTROL
    speed 200.0d0
    altitude 2500.0d0
    waypoint nil
    distance nil
    flaps 5
    decision-altitude 600
    landing-gear Up
    airbrakes Off
    autopilots Engaged
    task nil
    last-task nil
    status Active
    landing-checklist nil
 VISUAL    0.000 flaps Value 5
 CHUNK NIL IS UNDEFINED.
 CHUNK NIL IS UNDEFINED.
 PROCEDURAL    1.037 Preparing for approach: setting VNAV
 VISUAL    1.037 waypoint Value 1
 PROCEDURAL    2.074 Preparing for approach: setting LNAV
 VISUAL    2.074 distance-next Value 1
 PROCEDURAL    4.537 Preparing for approach: setting Flaps 1
 MANUAL    4.537 flaps set 1
 PROCEDURAL    5.766 Preparing for approach: engaging Autopilot
 VISUAL    5.766 autopilots Value up
 PROCEDURAL    9.185 Preparing for approach: engaging Speed-brakes full
 MANUAL    9.185 airbrakes on/off 0
 PROCEDURAL    9.340 SubGoal checking Flaps
 VISUAL   10.305 speed Value 200
 RETRIEVAL   10.455 Flaps 1
```

```
VISUAL   11.592 flaps Value 1
PROCEDURAL   11.642 Confirm Flaps already set to 1
**Goal6    5.119
   isa SET-FLAP
   speed 200
   flap 1GOAL6 SVS NIL NIL Flaps-Already-Set
PROCEDURAL   13.248 SubGoal checking Speed Brakes
VISUAL   14.194 speed Value 200
VISUAL   15.329 airbrakes Value on
PROCEDURAL   15.379 Setting Speed Brakes
MANUAL   17.766 airbrakes on/off 0
**Goal9    8.427
   isa SPEED-BRAKES
   speed 200
   decision OffGOAL9 DIAL SVS NIL Set-Speed-Brakes
PROCEDURAL   19.366 SubGoal checking Altitude
VISUAL   20.433 altitude Value 2500
**Goal13    5.067
   isa CHECK-ALTITUDE
   altitude 2500
   previous 2500.0d0GOAL13 DIAL SVS NIL Ignore-Altitude
PROCEDURAL   22.088 SubGoal checking Landing Gear
VISUAL   22.998 waypoint Value 2
VISUAL   24.143 distance-next Value 3
RETRIEVAL   24.243 Waypoint 2 Next 3 Distance 14
VISUAL   25.311 landing-gear Value up
PROCEDURAL   25.361 Lowering Gear
MANUAL   28.359 landing-gear up/down 0
**Goal15    9.114
   isa MOVE-GEAR
   waypoint 2
   distance-next 3
   distance 14
   decision DownGOAL15 SVS SVS T Move-Gear
PROCEDURAL   28.967 SubGoal checking Decision Altitude
VISUAL   30.109 waypoint Value 2
VISUAL   31.152 distance-next Value 3
RETRIEVAL   31.252 Waypoint 2 Next 3 Distance 14
**Goal20    5.601
   isa SET-DECISION-ALTITUDE
   waypoint 2
   distance-next 3
   distance 14
   old 600
   decision 600GOAL20 DIAL DIAL T Ignore-Decision-Altitude
PROCEDURAL   31.909 SubGoal setting Dial Altitude
VISUAL   32.719 waypoint Value 2
RETRIEVAL   33.120 Altitude 1800
VISUAL   34.309 dial-altitude Value 2500
MANUAL   36.568 dial-altitude set 1800
**Goal23    4.804
   isa DIAL-ALTITUDE
   waypoint 2
   altitude 1800GOAL23 DIAL DIAL T Dial-Altitude
PROCEDURAL   37.173 SubGoal checking Autopilot
VISUAL   38.205 otw_runway Value out-of-sight
VISUAL   39.333 autopilots Value up
```

```
VISUAL   40.612 altitude Value 2500
**Goal27    8.667
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 2500
   decision Engaged
   decision-altitude 600GOAL27 DIAL DIAL T Ignore-Autopilot
PROCEDURAL   41.313 SubGoal checking Speed
VISUAL   42.425 waypoint Value 2
VISUAL   43.592 distance-next Value 2
RETRIEVAL   43.692 Waypoint 2 Next 2 Distance 13
RETRIEVAL   43.843 Speed
VISUAL   44.682 dial-speed Value 200
MANUAL   47.666 dial-speed set 165
**Goal31    5.213
   isa SET-SPEED
   waypoint 2
   distance-next 2
   distance 13
   speed 165GOAL31 DIAL DIAL T Dial-Speed
PROCEDURAL   48.273 SubGoal checking Flaps
VISUAL   49.311 speed Value 199
RETRIEVAL   49.461 Flaps 1
VISUAL   50.536 flaps Value 1
PROCEDURAL   50.586 Confirm Flaps already set to 1
**Goal36    5.401
   isa SET-FLAP
   speed 199
   flap 1GOAL36 SVS DIAL NIL Flaps-Already-Set
PROCEDURAL   52.191 SubGoal checking Altitude
VISUAL   53.287 altitude Value 2500
**Goal39    5.072
   isa CHECK-ALTITUDE
   altitude 2500
   previous 2500GOAL39 SVS DIAL NIL Ignore-Altitude
PROCEDURAL   54.943 SubGoal checking Speed Brakes
VISUAL   55.950 speed Value 193
VISUAL   56.993 airbrakes Value off
**Goal41    7.813
   isa SPEED-BRAKES
   speed 193
   decision OffGOAL41 SVS SVS T Decide-Speed-Brakes
PROCEDURAL   57.593 SubGoal checking Decision Altitude
VISUAL   58.850 waypoint Value 2
VISUAL   59.702 distance-next Value 1
RETRIEVAL   59.802 Waypoint 2 Next 1 Distance 12
**Goal44    4.851
   isa SET-DECISION-ALTITUDE
   waypoint 2
   distance-next 1
   distance 12
   old 600
   decision 600GOAL44 DIAL SVS NIL Ignore-Decision-Altitude
PROCEDURAL   61.460 SubGoal setting Dial Altitude
VISUAL   62.644 waypoint Value 2
RETRIEVAL   62.794 Altitude 1800
VISUAL   63.642 dial-altitude Value 1800
```

```
PROCEDURAL   63.692 Confirm Altitude already set to 1800
**Goal47    5.277
   isa DIAL-ALTITUDE
   waypoint 2
   altitude 1800GOAL47 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL   64.299 SubGoal checking Landing Gear
VISUAL   65.471 waypoint Value 2
VISUAL   66.578 distance-next Value 1
RETRIEVAL   66.678 Waypoint 2 Next 1 Distance 12
VISUAL   67.636 landing-gear Value down
**Goal50    8.937
   isa MOVE-GEAR
   waypoint 2
   distance-next 1
   distance 12
   decision DownGOAL50 SVS SVS T Decide-Gear
PROCEDURAL   68.236 SubGoal checking Autopilot
VISUAL   69.326 otw_runway Value out-of-sight
VISUAL   70.444 autopilots Value up
VISUAL   71.712 altitude Value 2500
**Goal54    8.124
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 2500
   decision Engaged
   decision-altitude 600GOAL54 SVS SVS T Ignore-Autopilot
PROCEDURAL   72.413 SubGoal checking Speed
VISUAL   73.234 waypoint Value 2
VISUAL   74.289 distance-next Value 0
RETRIEVAL   74.389 Waypoint 2 Next 0 Distance 11
RETRIEVAL   74.489 Speed
VISUAL   75.498 dial-speed Value 165
PROCEDURAL   75.548 Confirm Speed already set to 165
**Goal58    5.230
   isa SET-SPEED
   waypoint 2
   distance-next 0
   distance 11
   speed 165GOAL58 DIAL SVS NIL Speed-Already-Dialed
PROCEDURAL   77.154 SubGoal checking Flaps
VISUAL   78.193 speed Value 176
RETRIEVAL   78.343 Flaps 25
VISUAL   79.460 flaps Value 1
MANUAL   81.496 flaps set 25
VISUAL   81.496 atc Value random-listen
CHUNK NIL IS UNDEFINED.
CHUNK NIL IS UNDEFINED.
VISUAL   81.496 atc Value ten-miles-out
CHUNK NIL IS UNDEFINED.
CHUNK NIL IS UNDEFINED.
**Goal62    5.039
   isa SET-FLAP
   speed 176
   flap 25GOAL62 SVS DIAL NIL Set-Flaps
PROCEDURAL   83.102 SubGoal checking Altitude
VISUAL   84.203 altitude Value 2423
**Goal66    5.127
```

```
   isa CHECK-ALTITUDE
   altitude 2423
   previous 2500GOAL66 SVS DIAL NIL Ignore-Altitude
PROCEDURAL   85.859 SubGoal checking Decision Altitude
VISUAL   87.143 waypoint Value 3
VISUAL   88.185 distance-next Value 2
RETRIEVAL   88.285 Waypoint 3 Next 2 Distance 11
**Goal68    5.090
   isa SET-DECISION-ALTITUDE
   waypoint 3
   distance-next 2
   distance 11
   old 600
   decision 600GOAL68 SVS DIAL NIL Ignore-Decision-Altitude
PROCEDURAL   89.943 SubGoal setting Dial Altitude
VISUAL   91.006 waypoint Value 3
RETRIEVAL   91.156 Altitude 1000
VISUAL   92.145 dial-altitude Value 1800
MANUAL   94.114 dial-altitude set 1000
**Goal71    4.938
   isa DIAL-ALTITUDE
   waypoint 3
   altitude 1000GOAL71 DIAL SVS NIL Dial-Altitude
PROCEDURAL   95.720 SubGoal checking Speed Brakes
VISUAL   96.905 speed Value 165
VISUAL   97.758 airbrakes Value off
**Goal75    8.171
   isa SPEED-BRAKES
   speed 165
   decision OffGOAL75 SVS DIAL NIL Decide-Speed-Brakes
PROCEDURAL   99.358 SubGoal checking Autopilot
VISUAL  100.517 otw_runway Value out-of-sight
VISUAL  101.450 autopilots Value up
VISUAL  102.404 altitude Value 2085
**Goal78    8.784
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 2085
   decision Engaged
   decision-altitude 600GOAL78 SVS DIAL NIL Ignore-Autopilot
PROCEDURAL  104.105 SubGoal checking Landing Gear
VISUAL  104.994 waypoint Value 3
VISUAL  106.267 distance-next Value 1
RETRIEVAL  106.367 Waypoint 3 Next 1 Distance 10
VISUAL  107.581 landing-gear Value down
**Goal82    8.444
   isa MOVE-GEAR
   waypoint 3
   distance-next 1
   distance 10
   decision DownGOAL82 SVS DIAL NIL Decide-Gear
PROCEDURAL  109.181 SubGoal checking Altitude
VISUAL  110.207 altitude Value 1941
**Goal86    5.083
   isa CHECK-ALTITUDE
   altitude 1941
   previous 2423GOAL86 SVS DIAL NIL Read-Altitude
```

```
PROCEDURAL  111.862 SubGoal setting Dial Altitude
VISUAL  113.116 waypoint Value 3
RETRIEVAL  113.266 Altitude 1000
VISUAL  114.308 dial-altitude Value 1000
PROCEDURAL  114.358 Confirm Altitude already set to 1000
**Goal88    4.588
   isa DIAL-ALTITUDE
   waypoint 3
   altitude 1000GOAL88 SVS SVS T Dial-Altitude-Already-Dialed
PROCEDURAL  114.964 SubGoal checking Altitude
VISUAL  115.857 altitude Value 1836
**Goal91    5.100
   isa CHECK-ALTITUDE
   altitude 1836
   previous 1941GOAL91 SVS SVS T Ignore-Altitude
PROCEDURAL  116.517 SubGoal checking Autopilot
VISUAL  117.779 otw_runway Value out-of-sight
VISUAL  118.800 autopilots Value up
VISUAL  119.652 altitude Value 1787
**Goal93    7.887
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1787
   decision Engaged
   decision-altitude 600GOAL93 SVS SVS T Ignore-Autopilot
PROCEDURAL  120.353 SubGoal checking Altitude
VISUAL  121.623 altitude Value 1774
**Goal97    4.912
   isa CHECK-ALTITUDE
   altitude 1774
   previous 1836GOAL97 SVS SVS T Ignore-Altitude
PROCEDURAL  122.278 SubGoal setting Dial Altitude
VISUAL  123.459 waypoint Value 4
RETRIEVAL  123.609 Altitude 700
VISUAL  124.640 dial-altitude Value 1000
MANUAL  126.844 dial-altitude set 700
**Goal99    4.998
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL99 SVS SVS T Dial-Altitude
PROCEDURAL  127.450 SubGoal completing landing checklist
PROCEDURAL  129.476 Landing checklist: setting Gear down 1
MANUAL  129.476 landing-gear up/down 0
PROCEDURAL  131.590 Landing checklist: setting Flaps 15
MANUAL  131.590 flaps set 15
PROCEDURAL  134.763 Landing checklist: setting Speed to 135
MANUAL  134.763 speed set 135
VISUAL  134.763 speed Value 165
CHUNK NIL IS UNDEFINED.
CHUNK NIL IS UNDEFINED.
PROCEDURAL  136.778 Landing checklist: preparing cabin for landing
VOCAL  136.778 nothing communication 2007
PROCEDURAL  139.953 Landing checklist: setting Speed-brakes to armed
MANUAL  139.953 airbrakes on/off 0
VOCAL  140.003 Landing Checklist Complete
PROCEDURAL  140.159 SubGoal checking Altitude
VISUAL  141.291 altitude Value 1635
```

```
**Goal110    4.898
   isa CHECK-ALTITUDE
   altitude 1635
   previous 1774GOAL110 SVS SVS T Ignore-Altitude
PROCEDURAL  141.947 SubGoal checking Autopilot
VISUAL  143.062 otw_runway Value out-of-sight
VISUAL  143.930 autopilots Value up
VISUAL  144.872 altitude Value 1610
**Goal112    8.156
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1610
   decision Engaged
   decision-altitude 600GOAL112 SVS SVS T Ignore-Autopilot
PROCEDURAL  145.573 SubGoal checking Altitude
VISUAL  146.632 altitude Value 1597
**Goal116    4.906
   isa CHECK-ALTITUDE
   altitude 1597
   previous 1635GOAL116 SVS SVS T Ignore-Altitude
PROCEDURAL  147.288 SubGoal checking Autopilot
VISUAL  148.163 otw_runway Value out-of-sight
VISUAL  149.061 autopilots Value up
VISUAL  150.028 altitude Value 1574
**Goal118    8.079
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1574
   decision Engaged
   decision-altitude 600GOAL118 SVS SVS T Ignore-Autopilot
PROCEDURAL  150.729 SubGoal checking Altitude
VISUAL  151.705 altitude Value 1562
**Goal122    5.183
   isa CHECK-ALTITUDE
   altitude 1562
   previous 1597GOAL122 SVS SVS T Ignore-Altitude
PROCEDURAL  152.359 SubGoal setting Dial Altitude
VISUAL  153.549 waypoint Value 4
RETRIEVAL  153.699 Altitude 700
VISUAL  154.727 dial-altitude Value 700
PROCEDURAL  154.777 Confirm Altitude already set to 700
**Goal124    4.855
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL124 SVS SVS T Dial-Altitude-Already-Dialed
PROCEDURAL  155.384 SubGoal checking Altitude
VISUAL  156.394 altitude Value 1529
**Goal127    4.890
   isa CHECK-ALTITUDE
   altitude 1529
   previous 1562GOAL127 SVS SVS T Ignore-Altitude
PROCEDURAL  157.051 SubGoal setting Dial Altitude
VISUAL  157.890 atc Value random-listen
VISUAL  157.890 waypoint Value 4
RETRIEVAL  158.040 Altitude 700
VISUAL  158.932 dial-altitude Value 700
PROCEDURAL  158.982 Confirm Altitude already set to 700
```

```
**Goal129    4.999
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL129 SVS SVS T Dial-Altitude-Already-Dialed
PROCEDURAL  159.588 SubGoal checking Altitude
VISUAL  160.724 altitude Value 1499
**Goal132    5.120
   isa CHECK-ALTITUDE
   altitude 1499
   previous 1529GOAL132 SVS SVS T Ignore-Altitude
PROCEDURAL  161.380 SubGoal checking Autopilot
VISUAL  162.526 otw_runway Value out-of-sight
VISUAL  163.742 autopilots Value up
VISUAL  164.663 altitude Value 1471
**Goal134    7.851
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1471
   decision Engaged
   decision-altitude 600GOAL134 SVS SVS T Ignore-Autopilot
PROCEDURAL  165.365 SubGoal checking Altitude
VISUAL  166.361 altitude Value 1459
**Goal138    4.898
   isa CHECK-ALTITUDE
   altitude 1459
   previous 1499GOAL138 SVS SVS T Ignore-Altitude
PROCEDURAL  167.019 SubGoal setting Dial Altitude
VISUAL  168.268 waypoint Value 4
RETRIEVAL  168.418 Altitude 700
VISUAL  169.548 dial-altitude Value 700
PROCEDURAL  169.598 Confirm Altitude already set to 700
**Goal140    4.934
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL140 SVS SVS T Dial-Altitude-Already-Dialed
PROCEDURAL  170.203 SubGoal checking Altitude
VISUAL  171.296 altitude Value 1424
**Goal143    5.145
   isa CHECK-ALTITUDE
   altitude 1424
   previous 1459GOAL143 SVS SVS T Ignore-Altitude
PROCEDURAL  171.955 SubGoal checking Autopilot
VISUAL  172.976 otw_runway Value out-of-sight
VISUAL  173.990 autopilots Value up
VISUAL  175.155 altitude Value 1397
**Goal145    7.825
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1397
   decision Engaged
   decision-altitude 600GOAL145 SVS SVS T Ignore-Autopilot
PROCEDURAL  175.856 SubGoal checking Altitude
VISUAL  176.675 altitude Value 1386
**Goal149    4.709
   isa CHECK-ALTITUDE
   altitude 1386
   previous 1424GOAL149 SVS SVS T Ignore-Altitude
```

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PROCEDURAL  177.331 SubGoal setting Dial Altitude
VISUAL  178.166 waypoint Value 4
RETRIEVAL  178.316 Altitude 700
VISUAL  179.535 dial-altitude Value 700
PROCEDURAL  179.585 Confirm Altitude already set to 700
**Goal151    4.867
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL151 SVS SVS T Dial-Altitude-Already-Dialed
PROCEDURAL  180.191 SubGoal checking Altitude
VISUAL  181.062 altitude Value 1355
**Goal154    4.947
   isa CHECK-ALTITUDE
   altitude 1355
   previous 1386GOAL154 SVS SVS T Ignore-Altitude
PROCEDURAL  181.716 SubGoal setting Dial Altitude
VISUAL  182.578 waypoint Value 4
RETRIEVAL  182.728 Altitude 700
VISUAL  183.487 dial-altitude Value 700
PROCEDURAL  183.537 Confirm Altitude already set to 700
**Goal156    5.062
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL156 SVS SVS T Dial-Altitude-Already-Dialed
PROCEDURAL  184.145 SubGoal checking Altitude
VISUAL  185.259 altitude Value 1326
**Goal159    4.968
   isa CHECK-ALTITUDE
   altitude 1326
   previous 1355GOAL159 SVS SVS T Ignore-Altitude
PROCEDURAL  185.915 SubGoal setting Dial Altitude
VISUAL  187.212 waypoint Value 4
RETRIEVAL  187.362 Altitude 700
VISUAL  188.317 dial-altitude Value 700
PROCEDURAL  188.367 Confirm Altitude already set to 700
**Goal161    5.235
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL161 SVS SVS T Dial-Altitude-Already-Dialed
PROCEDURAL  188.974 SubGoal checking Altitude
VISUAL  189.873 altitude Value 1293
**Goal164    4.869
   isa CHECK-ALTITUDE
   altitude 1293
   previous 1326GOAL164 SVS SVS T Ignore-Altitude
PROCEDURAL  190.529 SubGoal checking Autopilot
VISUAL  191.546 otw_runway Value out-of-sight
VISUAL  192.399 autopilots Value up
VISUAL  193.360 altitude Value 1269
**Goal166    7.920
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1269
   decision Engaged
   decision-altitude 600GOAL166 SVS SVS T Ignore-Autopilot
PROCEDURAL  194.062 SubGoal checking Altitude
VISUAL  195.001 altitude Value 1257
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**Goal170    5.202
   isa CHECK-ALTITUDE
   altitude 1257
   previous 1293GOAL170 SVS SVS T Ignore-Altitude
PROCEDURAL  195.660 SubGoal setting Dial Altitude
VISUAL  196.678 waypoint Value 4
RETRIEVAL  196.828 Altitude 700
VISUAL  198.042 dial-altitude Value 700
PROCEDURAL  198.092 Confirm Altitude already set to 700
**Goal172    4.831
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL172 SVS SVS T Dial-Altitude-Already-Dialed
PROCEDURAL  198.700 SubGoal checking Altitude
VISUAL  199.701 altitude Value 1224
**Goal175    4.957
   isa CHECK-ALTITUDE
   altitude 1224
   previous 1257GOAL175 SVS SVS T Ignore-Altitude
PROCEDURAL  200.360 SubGoal checking Autopilot
VISUAL  201.653 otw_runway Value out-of-sight
VISUAL  202.565 autopilots Value up
VISUAL  203.719 altitude Value 1196
**Goal177    7.761
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1196
   decision Engaged
   decision-altitude 600GOAL177 SVS SVS T Ignore-Autopilot
PROCEDURAL  204.420 SubGoal checking Altitude
VISUAL  205.318 altitude Value 1185
**Goal181    5.073
   isa CHECK-ALTITUDE
   altitude 1185
   previous 1224GOAL181 SVS SVS T Ignore-Altitude
PROCEDURAL  205.975 SubGoal setting Dial Altitude
VISUAL  206.973 waypoint Value 4
RETRIEVAL  207.123 Altitude 700
VISUAL  208.365 dial-altitude Value 700
PROCEDURAL  208.415 Confirm Altitude already set to 700
**Goal183    5.086
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL183 SVS SVS T Dial-Altitude-Already-Dialed
PROCEDURAL  209.021 SubGoal checking Altitude
VISUAL  210.043 altitude Value 1151
**Goal186    5.033
   isa CHECK-ALTITUDE
   altitude 1151
   previous 1185GOAL186 SVS SVS T Ignore-Altitude
PROCEDURAL  210.700 SubGoal setting Dial Altitude
VISUAL  211.594 waypoint Value 4
RETRIEVAL  211.744 Altitude 700
VISUAL  212.600 dial-altitude Value 700
PROCEDURAL  212.650 Confirm Altitude already set to 700
**Goal188    4.744
   isa DIAL-ALTITUDE
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   waypoint 4
   altitude 700GOAL188 DIAL SVS NIL Dial-Altitude-Already-Dialed
PROCEDURAL  214.257 SubGoal checking Altitude
VISUAL  215.193 altitude Value 1115
**Goal191    4.958
   isa CHECK-ALTITUDE
   altitude 1115
   previous 1151GOAL191 DIAL SVS NIL Ignore-Altitude
PROCEDURAL  216.848 SubGoal checking Autopilot
VISUAL  217.989 otw_runway Value out-of-sight
VISUAL  219.256 autopilots Value up
VISUAL  220.125 altitude Value 1081
**Goal193    8.110
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1081
   decision Engaged
   decision-altitude 600GOAL193 DIAL SVS NIL Ignore-Autopilot
PROCEDURAL  221.826 SubGoal checking Altitude
VISUAL  222.823 altitude Value 1062
**Goal197    5.073
   isa CHECK-ALTITUDE
   altitude 1062
   previous 1115GOAL197 DIAL SVS NIL Ignore-Altitude
PROCEDURAL  224.479 SubGoal setting Dial Altitude
VISUAL  225.481 waypoint Value 4
RETRIEVAL  225.631 Altitude 700
VISUAL  226.781 dial-altitude Value 700
PROCEDURAL  226.831 Confirm Altitude already set to 700
**Goal199    4.840
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL199 SVS DIAL NIL Dial-Altitude-Already-Dialed
PROCEDURAL  228.437 SubGoal checking Altitude
VISUAL  229.346 altitude Value 1016
**Goal202    5.165
   isa CHECK-ALTITUDE
   altitude 1016
   previous 1062GOAL202 SVS DIAL NIL Ignore-Altitude
PROCEDURAL  231.002 SubGoal setting Dial Altitude
VISUAL  232.156 atc Value late-reassignment
VISUAL  232.156 waypoint Value 5
RETRIEVAL  232.307 Altitude 500
VISUAL  233.418 dial-altitude Value 700
MANUAL  236.491 dial-altitude set 500
**Goal204    4.853
   isa DIAL-ALTITUDE
   waypoint 5
   altitude 500GOAL204 DIAL SVS NIL Dial-Altitude
PROCEDURAL  238.098 SubGoal checking Altitude
VISUAL  239.354 altitude Value 876
**Goal208    5.133
   isa CHECK-ALTITUDE
   altitude 876
   previous 1016GOAL208 DIAL SVS NIL Ignore-Altitude
PROCEDURAL  241.010 SubGoal checking Autopilot
VISUAL  242.001 atc Value random-no-listen
```

```
 VISUAL  242.001 otw_runway Value out-of-sight
 VISUAL  242.840 autopilots Value up
 VISUAL  243.862 altitude Value 805
 **Goal210    7.863
    isa SET-AUTOPILOT
    visibility Out-Of-Sight
    peek 805
    decision Engaged
    decision-altitude 600GOAL210 DIAL SVS NIL Ignore-Autopilot
 PROCEDURAL  245.564 SubGoal checking Altitude
 VISUAL  246.657 altitude Value 761
 **Goal214    5.187
    isa CHECK-ALTITUDE
    altitude 761
    previous 876GOAL214 DIAL SVS NIL Ignore-Altitude
 PROCEDURAL  248.313 SubGoal setting Dial Altitude
 VISUAL  249.292 waypoint Value 5
 RETRIEVAL  249.442 Altitude 500
 VISUAL  250.430 dial-altitude Value 500
 PROCEDURAL  250.480 Confirm Altitude already set to 500
 **Goal216    4.823
    isa DIAL-ALTITUDE
    waypoint 5
    altitude 500GOAL216 SVS DIAL NIL Dial-Altitude-Already-Dialed
 PROCEDURAL  252.087 SubGoal checking Altitude
 VISUAL  253.099 altitude Value 629
 **Goal219    5.043
    isa CHECK-ALTITUDE
    altitude 629
    previous 761GOAL219 SVS DIAL NIL Ignore-Altitude
 PROCEDURAL  254.755 SubGoal checking Autopilot
 VISUAL  256.045 otw_runway Value in-sight
 VISUAL  256.959 autopilots Value up
 PROCEDURAL  257.009 Disengage Autopilot and land
 MANUAL  259.466 autopilots up/down 0
 **Goal221    9.748
    isa SET-AUTOPILOT
    visibility In-Sight
    peek nil
    decision Disengaged
    decision-altitude 600GOAL221 SVS DIAL NIL Disengage-Autopilot


*** Finis  ***


*** Setting ModelDone to 1***

 MCP NAV PFD SVS CONTROLS OTW off Total-time
 26.581398 77.65663 74.76151 26.460136 16.370495 18.574535 20.61499
261.0197
EMC End:T 261.0197

Look 1.0 Action 2.5 Listen 0.5 Ans 0.1


;; Factory is idle.
```

9-SVS IMC Missed approach (go around)

```
dribbling to file "NASA-hpm-model-results.drb"

; Fast loading
;    C:\Documents and Settings\bbest\My Documents\Completed
Projects\NASA HEM\NasaHEMv07-Jul-
2005\nasav07\HPMv7\delivery\ole\client\autotool.fasl
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Projects\NASA HEM\NasaHEMv07-Jul-
2005\nasav07\HPMv7\delivery\ole\client\iclassfactory.fasl

Factory Started
CL-USER(1): (register-server)
Resistered Server EMC_NASAHPM.EMCReceiveCOMMessages
NIL
CL-USER(2):
Subject 0 Trial 0 Run 1
Initializing control

 Control    4.555
    isa CONTROL
    speed 200.0d0
    altitude 2500.0d0
    waypoint nil
    distance nil
    flaps 5
    decision-altitude 600
    landing-gear Up
    airbrakes Off
    autopilots Engaged
    task nil
    last-task nil
    status Active
    landing-checklist nil
 VISUAL    0.000 flaps Value 5
 CHUNK NIL IS UNDEFINED.
 CHUNK NIL IS UNDEFINED.
 PROCEDURAL    1.271 Preparing for approach: engaging Autopilot
 VISUAL    1.271 autopilots Value up
 PROCEDURAL    3.516 Preparing for approach: setting Flaps 1
 MANUAL    3.516 flaps set 1
 PROCEDURAL    4.690 Preparing for approach: setting LNAV
 VISUAL    4.690 distance-next Value 1
 PROCEDURAL    8.378 Preparing for approach: engaging Speed-brakes full
 MANUAL    8.378 airbrakes on/off 0
 PROCEDURAL    9.289 Preparing for approach: setting VNAV
 VISUAL    9.289 waypoint Value 1
 PROCEDURAL    9.446 SubGoal checking Landing Gear
 VISUAL   10.300 waypoint Value 1
 VISUAL   11.593 distance-next Value 0
```

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RETRIEVAL   11.693 Waypoint 1 Next 0 Distance 15
VISUAL   12.879 landing-gear Value up
PROCEDURAL   12.929 Lowering Gear
MANUAL   14.912 landing-gear up/down 0
**Goal6    8.871
   isa MOVE-GEAR
   waypoint 1
   distance-next 0
   distance 15
   decision DownGOAL6 DIAL DIAL T Move-Gear
PROCEDURAL   15.516 SubGoal checking Autopilot
VISUAL   16.667 otw_runway Value out-of-sight
VISUAL   17.956 autopilots Value up
VISUAL   19.155 altitude Value 2500
**Goal11    8.635
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 2500
   decision Engaged
   decision-altitude 600GOAL11 DIAL DIAL T Ignore-Autopilot
PROCEDURAL   19.856 SubGoal checking Decision Altitude
VISUAL   20.705 waypoint Value 2
VISUAL   21.966 distance-next Value 4
RETRIEVAL   22.066 Waypoint 2 Next 4 Distance 15
**Goal15    4.718
   isa SET-DECISION-ALTITUDE
   waypoint 2
   distance-next 4
   distance 15
   old 600
   decision 600GOAL15 SVS SVS T Ignore-Decision-Altitude
PROCEDURAL   22.722 SubGoal checking Speed
VISUAL   23.799 waypoint Value 2
VISUAL   24.843 distance-next Value 3
RETRIEVAL   24.943 Waypoint 2 Next 3 Distance 14
RETRIEVAL   25.043 Speed
VISUAL   25.887 dial-speed Value 200
MANUAL   28.483 dial-speed set 165
**Goal18    5.165
   isa SET-SPEED
   waypoint 2
   distance-next 3
   distance 14
   speed 165GOAL18 SVS SVS T Dial-Speed
PROCEDURAL   29.089 SubGoal checking Speed Brakes
VISUAL   29.907 speed Value 199
VISUAL   30.816 airbrakes Value on
PROCEDURAL   30.866 Setting Speed Brakes
MANUAL   33.026 airbrakes on/off 0
**Goal23    8.451
   isa SPEED-BRAKES
   speed 199
   decision OffGOAL23 SVS SVS T Set-Speed-Brakes
PROCEDURAL   33.626 SubGoal checking Flaps
VISUAL   34.441 speed Value 195
RETRIEVAL   34.641 Flaps 20
VISUAL   35.558 flaps Value 1
```

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MANUAL   38.480 flaps set 20
**Goal27    4.811
   isa SET-FLAP
   speed 195
   flap 20GOAL27 DIAL SVS NIL Set-Flaps
PROCEDURAL   40.087 SubGoal setting Dial Altitude
VISUAL   41.184 waypoint Value 2
RETRIEVAL   41.334 Altitude 1800
VISUAL   42.157 dial-altitude Value 2500
MANUAL   44.259 dial-altitude set 1800
**Goal31    4.668
   isa DIAL-ALTITUDE
   waypoint 2
   altitude 1800GOAL31 DIAL DIAL T Dial-Altitude
PROCEDURAL   44.865 SubGoal checking Altitude
VISUAL   46.043 altitude Value 2500
**Goal35    5.033
   isa CHECK-ALTITUDE
   altitude 2500
   previous 2500.0d0GOAL35 DIAL DIAL T Ignore-Altitude
PROCEDURAL   46.702 SubGoal checking Decision Altitude
VISUAL   47.721 waypoint Value 2
VISUAL   48.623 distance-next Value 2
RETRIEVAL   48.723 Waypoint 2 Next 2 Distance 13
**Goal37    5.217
   isa SET-DECISION-ALTITUDE
   waypoint 2
   distance-next 2
   distance 13
   old 600
   decision 600GOAL37 SVS SVS T Ignore-Decision-Altitude
PROCEDURAL   49.383 SubGoal checking Landing Gear
VISUAL   50.631 waypoint Value 2
VISUAL   51.778 distance-next Value 2
RETRIEVAL   51.878 Waypoint 2 Next 2 Distance 13
VISUAL   53.059 landing-gear Value down
**Goal40    8.526
   isa MOVE-GEAR
   waypoint 2
   distance-next 2
   distance 13
   decision DownGOAL40 SVS SVS T Decide-Gear
PROCEDURAL   53.659 SubGoal checking Autopilot
VISUAL   54.900 otw_runway Value out-of-sight
VISUAL   56.110 autopilots Value up
VISUAL   57.370 altitude Value 2500
**Goal44    8.450
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 2500
   decision Engaged
   decision-altitude 600GOAL44 SVS SVS T Ignore-Autopilot
PROCEDURAL   58.071 SubGoal checking Speed
VISUAL   59.181 waypoint Value 2
VISUAL   60.487 distance-next Value 1
RETRIEVAL   60.587 Waypoint 2 Next 1 Distance 12
RETRIEVAL   60.687 Speed
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VISUAL   61.761 dial-speed Value 165
MANUAL   63.954 dial-speed set 140
**Goal48    4.711
   isa SET-SPEED
   waypoint 2
   distance-next 1
   distance 12
   speed 140GOAL48 DIAL SVS NIL Dial-Speed
PROCEDURAL   65.564 SubGoal checking Speed Brakes
VISUAL   66.679 speed Value 169
VISUAL   67.779 airbrakes Value off
**Goal53    8.476
   isa SPEED-BRAKES
   speed 169
   decision OffGOAL53 SVS DIAL NIL Decide-Speed-Brakes
PROCEDURAL   69.379 SubGoal checking Altitude
VISUAL   70.599 altitude Value 2500
**Goal56    4.986
   isa CHECK-ALTITUDE
   altitude 2500
   previous 2500GOAL56 SVS DIAL NIL Ignore-Altitude
PROCEDURAL   72.255 SubGoal setting Dial Altitude
VISUAL   73.202 waypoint Value 2
RETRIEVAL   73.352 Altitude 1800
VISUAL   74.110 dial-altitude Value 1800
PROCEDURAL   74.160 Confirm Altitude already set to 1800
**Goal58    4.845
   isa DIAL-ALTITUDE
   waypoint 2
   altitude 1800GOAL58 DIAL SVS NIL Dial-Altitude-Already-Dialed
PROCEDURAL   75.767 SubGoal checking Flaps
VISUAL   76.697 speed Value 161
RETRIEVAL   76.847 Flaps 25
VISUAL   78.072 flaps Value 20
MANUAL   80.714 flaps set 25
VISUAL   80.714 atc Value random-listen
CHUNK NIL IS UNDEFINED.
CHUNK NIL IS UNDEFINED.
**Goal61    4.926
   isa SET-FLAP
   speed 161
   flap 25GOAL61 SVS DIAL NIL Set-Flaps
PROCEDURAL   82.320 SubGoal checking Decision Altitude
VISUAL   83.216 waypoint Value 2
VISUAL   84.160 distance-next Value 0
RETRIEVAL   84.260 Waypoint 2 Next 0 Distance 11
**Goal65    5.083
   isa SET-DECISION-ALTITUDE
   waypoint 2
   distance-next 0
   distance 11
   old 600
   decision 600GOAL65 SVS SVS T Ignore-Decision-Altitude
PROCEDURAL   84.917 SubGoal checking Altitude
VISUAL   85.786 atc Value ten-miles-out
VISUAL   85.786 altitude Value 2473
**Goal68    4.789
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   isa CHECK-ALTITUDE
   altitude 2473
   previous 2500GOAL68 SVS SVS T Ignore-Altitude
PROCEDURAL   86.443 SubGoal checking Landing Gear
VISUAL   87.412 waypoint Value 3
VISUAL   88.716 distance-next Value 2
RETRIEVAL   88.816 Waypoint 3 Next 2 Distance 11
VISUAL   89.889 landing-gear Value down
**Goal70    8.317
   isa MOVE-GEAR
   waypoint 3
   distance-next 2
   distance 11
   decision DownGOAL70 SVS SVS T Decide-Gear
PROCEDURAL   90.489 SubGoal checking Autopilot
VISUAL   91.579 otw_runway Value out-of-sight
VISUAL   92.866 autopilots Value up
VISUAL   93.893 altitude Value 2331
**Goal74    8.329
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 2331
   decision Engaged
   decision-altitude 600GOAL74 SVS SVS T Ignore-Autopilot
PROCEDURAL   94.594 SubGoal checking Speed Brakes
VISUAL   95.499 speed Value 156
VISUAL   96.733 airbrakes Value off
**Goal78    8.350
   isa SPEED-BRAKES
   speed 156
   decision OffGOAL78 DIAL SVS NIL Decide-Speed-Brakes
PROCEDURAL   98.333 SubGoal setting Dial Altitude
VISUAL   99.211 waypoint Value 3
RETRIEVAL   99.361 Altitude 1000
VISUAL  100.547 dial-altitude Value 1800
MANUAL  102.863 dial-altitude set 1000
**Goal81    4.849
   isa DIAL-ALTITUDE
   waypoint 3
   altitude 1000GOAL81 DIAL DIAL T Dial-Altitude
PROCEDURAL  103.471 SubGoal checking Altitude
VISUAL  104.711 altitude Value 2143
**Goal85    4.708
   isa CHECK-ALTITUDE
   altitude 2143
   previous 2473GOAL85 DIAL DIAL T Read-Altitude
PROCEDURAL  105.368 SubGoal checking Decision Altitude
VISUAL  106.301 waypoint Value 3
VISUAL  107.175 distance-next Value 1
RETRIEVAL  107.275 Waypoint 3 Next 1 Distance 10
**Goal87    5.215
   isa SET-DECISION-ALTITUDE
   waypoint 3
   distance-next 1
   distance 10
   old 600
   decision 600GOAL87 SVS SVS T Ignore-Decision-Altitude
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PROCEDURAL  107.932 SubGoal checking Speed
VISUAL  109.152 waypoint Value 3
VISUAL  110.299 distance-next Value 1
RETRIEVAL  110.399 Waypoint 3 Next 1 Distance 10
RETRIEVAL  110.499 Speed
VISUAL  111.451 dial-speed Value 140
PROCEDURAL  111.501 Confirm Speed already set to 140
**Goal90    5.069
   isa SET-SPEED
   waypoint 3
   distance-next 1
   distance 10
   speed 140GOAL90 SVS SVS T Speed-Already-Dialed
PROCEDURAL  112.112 SubGoal checking Altitude
VISUAL  112.952 altitude Value 2001
**Goal94    4.910
   isa CHECK-ALTITUDE
   altitude 2001
   previous 2143GOAL94 SVS SVS T Ignore-Altitude
PROCEDURAL  113.612 SubGoal checking Flaps
VISUAL  114.747 speed Value 152
RETRIEVAL  114.897 Flaps 25
VISUAL  115.777 flaps Value 25
PROCEDURAL  115.827 Confirm Flaps already set to 25
**Goal96    5.055
   isa SET-FLAP
   speed 152
   flap 25GOAL96 DIAL SVS NIL Flaps-Already-Set
PROCEDURAL  117.433 SubGoal checking Autopilot
VISUAL  118.386 otw_runway Value out-of-sight
VISUAL  119.630 autopilots Value up
VISUAL  120.922 altitude Value 1867
**Goal99    8.549
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1867
   decision Engaged
   decision-altitude 600GOAL99 DIAL SVS NIL Ignore-Autopilot
PROCEDURAL  122.623 SubGoal checking Landing Gear
VISUAL  123.866 waypoint Value 3
VISUAL  125.202 distance-next Value 6
RETRIEVAL  125.302 Waypoint 3 Next 6 Distance 15
VISUAL  126.109 landing-gear Value down
**Goal103    7.734
   isa MOVE-GEAR
   waypoint 3
   distance-next 6
   distance 15
   decision DownGOAL103 SVS SVS T Decide-Gear
PROCEDURAL  126.709 SubGoal checking Speed Brakes
VISUAL  127.888 speed Value 149
VISUAL  129.076 airbrakes Value off
**Goal107    8.139
   isa SPEED-BRAKES
   speed 149
   decision OffGOAL107 DIAL SVS NIL Decide-Speed-Brakes
PROCEDURAL  130.676 SubGoal checking Decision Altitude
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VISUAL  131.631 waypoint Value 4
VISUAL  132.659 distance-next Value 6
RETRIEVAL  132.759 Waypoint 4 Next 6 Distance 9
**Goal110    4.984
   isa SET-DECISION-ALTITUDE
   waypoint 4
   distance-next 6
   distance 9
   old 600
   decision 600GOAL110 SVS SVS T Ignore-Decision-Altitude
PROCEDURAL  133.416 SubGoal checking Altitude
VISUAL  134.400 altitude Value 1740
**Goal113    5.320
   isa CHECK-ALTITUDE
   altitude 1740
   previous 2001GOAL113 SVS SVS T Read-Altitude
PROCEDURAL  135.059 SubGoal setting Dial Altitude
VISUAL  135.965 waypoint Value 4
RETRIEVAL  136.116 Altitude 700
VISUAL  137.131 dial-altitude Value 1000
MANUAL  140.166 dial-altitude set 700
**Goal115    4.870
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL115 SVS SVS T Dial-Altitude
PROCEDURAL  140.773 SubGoal completing landing checklist
PROCEDURAL  143.584 Landing checklist: preparing cabin for landing
VOCAL  143.584 nothing communication 2007
PROCEDURAL  146.018 Landing checklist: setting Gear down 1
MANUAL  146.018 landing-gear up/down 0
PROCEDURAL  148.381 Landing checklist: setting Flaps 15
MANUAL  148.381 flaps set 15
PROCEDURAL  152.632 Landing checklist: setting Speed-brakes to armed
MANUAL  152.632 airbrakes on/off 0
PROCEDURAL  155.788 Landing checklist: setting Speed to 135
MANUAL  155.788 speed set 135
VISUAL  155.788 speed Value 144
VOCAL  155.838 Landing Checklist Complete
PROCEDURAL  155.996 SubGoal checking Altitude
VISUAL  157.193 altitude Value 1599
**Goal126    5.004
   isa CHECK-ALTITUDE
   altitude 1599
   previous 1740GOAL126 SVS SVS T Ignore-Altitude
PROCEDURAL  157.854 SubGoal checking Autopilot
VISUAL  159.059 atc Value random-no-listen
VISUAL  159.059 otw_runway Value out-of-sight
VISUAL  159.998 autopilots Value up
VISUAL  161.072 altitude Value 1575
**Goal128    8.365
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1575
   decision Engaged
   decision-altitude 600GOAL128 SVS SVS T Ignore-Autopilot
PROCEDURAL  161.773 SubGoal checking Altitude
VISUAL  162.701 altitude Value 1565
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**Goal132    4.856
   isa CHECK-ALTITUDE
   altitude 1565
   previous 1599GOAL132 SVS SVS T Ignore-Altitude
PROCEDURAL  163.359 SubGoal setting Dial Altitude
VISUAL  164.641 waypoint Value 4
RETRIEVAL  164.791 Altitude 700
VISUAL  165.829 dial-altitude Value 700
PROCEDURAL  165.879 Confirm Altitude already set to 700
**Goal134    4.361
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL134 SVS SVS T Dial-Altitude-Already-Dialed
PROCEDURAL  166.486 SubGoal checking Altitude
VISUAL  167.461 altitude Value 1536
**Goal137    4.909
   isa CHECK-ALTITUDE
   altitude 1536
   previous 1565GOAL137 SVS SVS T Ignore-Altitude
PROCEDURAL  168.121 SubGoal checking Autopilot
VISUAL  169.346 otw_runway Value out-of-sight
VISUAL  170.488 autopilots Value up
VISUAL  171.301 altitude Value 1513
**Goal139    7.840
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1513
   decision Engaged
   decision-altitude 600GOAL139 SVS SVS T Ignore-Autopilot
PROCEDURAL  172.002 SubGoal checking Altitude
VISUAL  172.989 altitude Value 1503
**Goal143    4.800
   isa CHECK-ALTITUDE
   altitude 1503
   previous 1536GOAL143 SVS SVS T Ignore-Altitude
PROCEDURAL  173.647 SubGoal setting Dial Altitude
VISUAL  174.836 waypoint Value 4
RETRIEVAL  174.986 Altitude 700
VISUAL  176.168 dial-altitude Value 700
PROCEDURAL  176.218 Confirm Altitude already set to 700
**Goal145    5.119
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL145 DIAL SVS NIL Dial-Altitude-Already-Dialed
PROCEDURAL  177.825 SubGoal checking Altitude
VISUAL  179.114 altitude Value 1467
**Goal148    4.766
   isa CHECK-ALTITUDE
   altitude 1467
   previous 1503GOAL148 DIAL SVS NIL Ignore-Altitude
PROCEDURAL  180.771 SubGoal checking Autopilot
VISUAL  181.955 otw_runway Value out-of-sight
VISUAL  183.041 autopilots Value up
VISUAL  184.262 altitude Value 1436
**Goal150    8.022
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
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   peek 1436
   decision Engaged
   decision-altitude 600GOAL150 DIAL SVS NIL Ignore-Autopilot
PROCEDURAL  185.963 SubGoal checking Altitude
VISUAL  187.108 altitude Value 1419
**Goal154    5.362
   isa CHECK-ALTITUDE
   altitude 1419
   previous 1467GOAL154 DIAL SVS NIL Ignore-Altitude
PROCEDURAL  188.764 SubGoal setting Dial Altitude
VISUAL  189.953 waypoint Value 4
RETRIEVAL  190.103 Altitude 700
VISUAL  191.030 dial-altitude Value 700
PROCEDURAL  191.080 Confirm Altitude already set to 700
**Goal156    4.836
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL156 SVS DIAL NIL Dial-Altitude-Already-Dialed
PROCEDURAL  192.687 SubGoal checking Altitude
VISUAL  193.738 altitude Value 1379
**Goal159    5.114
   isa CHECK-ALTITUDE
   altitude 1379
   previous 1419GOAL159 SVS DIAL NIL Ignore-Altitude
PROCEDURAL  195.395 SubGoal checking Autopilot
VISUAL  196.462 otw_runway Value out-of-sight
VISUAL  197.709 autopilots Value up
VISUAL  198.898 altitude Value 1348
**Goal161    8.105
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1348
   decision Engaged
   decision-altitude 600GOAL161 SVS DIAL NIL Ignore-Autopilot
PROCEDURAL  200.599 SubGoal checking Altitude
VISUAL  201.517 altitude Value 1333
**Goal165    5.055
   isa CHECK-ALTITUDE
   altitude 1333
   previous 1379GOAL165 SVS DIAL NIL Ignore-Altitude
PROCEDURAL  203.173 SubGoal setting Dial Altitude
VISUAL  204.022 waypoint Value 4
RETRIEVAL  204.172 Altitude 700
VISUAL  205.329 dial-altitude Value 700
PROCEDURAL  205.379 Confirm Altitude already set to 700
**Goal167    4.963
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL167 SVS SVS T Dial-Altitude-Already-Dialed
PROCEDURAL  205.986 SubGoal checking Altitude
VISUAL  207.277 altitude Value 1298
**Goal170    5.212
   isa CHECK-ALTITUDE
   altitude 1298
   previous 1333GOAL170 SVS SVS T Ignore-Altitude
PROCEDURAL  207.933 SubGoal setting Dial Altitude
VISUAL  208.785 waypoint Value 4
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RETRIEVAL  208.935 Altitude 700
VISUAL  210.091 dial-altitude Value 700
PROCEDURAL  210.141 Confirm Altitude already set to 700
**Goal172    4.841
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL172 DIAL SVS NIL Dial-Altitude-Already-Dialed
PROCEDURAL  211.747 SubGoal checking Altitude
VISUAL  212.646 altitude Value 1266
**Goal175    5.202
   isa CHECK-ALTITUDE
   altitude 1266
   previous 1298GOAL175 DIAL SVS NIL Ignore-Altitude
PROCEDURAL  214.303 SubGoal setting Dial Altitude
VISUAL  215.326 waypoint Value 4
RETRIEVAL  215.476 Altitude 700
VISUAL  216.267 dial-altitude Value 700
PROCEDURAL  216.317 Confirm Altitude already set to 700
**Goal177    4.915
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL177 SVS DIAL NIL Dial-Altitude-Already-Dialed
PROCEDURAL  217.925 SubGoal checking Altitude
VISUAL  218.863 altitude Value 1229
**Goal180    4.927
   isa CHECK-ALTITUDE
   altitude 1229
   previous 1266GOAL180 SVS DIAL NIL Ignore-Altitude
PROCEDURAL  220.519 SubGoal setting Dial Altitude
VISUAL  221.672 waypoint Value 4
RETRIEVAL  221.822 Altitude 700
VISUAL  222.798 dial-altitude Value 700
PROCEDURAL  222.848 Confirm Altitude already set to 700
**Goal182    5.124
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL182 SVS SVS T Dial-Altitude-Already-Dialed
PROCEDURAL  223.454 SubGoal checking Altitude
VISUAL  224.282 altitude Value 1197
**Goal185    5.123
   isa CHECK-ALTITUDE
   altitude 1197
   previous 1229GOAL185 SVS SVS T Ignore-Altitude
PROCEDURAL  224.941 SubGoal setting Dial Altitude
VISUAL  225.890 waypoint Value 4
RETRIEVAL  226.040 Altitude 700
VISUAL  226.952 dial-altitude Value 700
PROCEDURAL  227.002 Confirm Altitude already set to 700
**Goal187    4.860
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL187 SVS SVS T Dial-Altitude-Already-Dialed
PROCEDURAL  227.610 SubGoal checking Altitude
VISUAL  228.720 altitude Value 1170
**Goal190    5.069
   isa CHECK-ALTITUDE
   altitude 1170
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   previous 1197GOAL190 SVS SVS T Ignore-Altitude
PROCEDURAL  229.376 SubGoal setting Dial Altitude
VISUAL  230.640 waypoint Value 4
RETRIEVAL  230.840 Altitude 700
VISUAL  231.756 dial-altitude Value 700
PROCEDURAL  231.806 Confirm Altitude already set to 700
**Goal192    4.999
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL192 SVS SVS T Dial-Altitude-Already-Dialed
PROCEDURAL  232.413 SubGoal checking Altitude
VISUAL  233.656 altitude Value 1140
**Goal195    4.822
   isa CHECK-ALTITUDE
   altitude 1140
   previous 1170GOAL195 SVS SVS T Ignore-Altitude
PROCEDURAL  234.312 SubGoal setting Dial Altitude
VISUAL  235.478 waypoint Value 4
RETRIEVAL  235.628 Altitude 700
VISUAL  236.661 dial-altitude Value 700
PROCEDURAL  236.711 Confirm Altitude already set to 700
**Goal197    4.874
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL197 DIAL SVS NIL Dial-Altitude-Already-Dialed
PROCEDURAL  238.317 SubGoal checking Altitude
VISUAL  239.604 atc Value random-no-listen
VISUAL  239.604 altitude Value 1105
**Goal200    5.023
   isa CHECK-ALTITUDE
   altitude 1105
   previous 1140GOAL200 DIAL SVS NIL Ignore-Altitude
PROCEDURAL  241.260 SubGoal checking Autopilot
VISUAL  242.115 otw_runway Value out-of-sight
VISUAL  242.995 autopilots Value up
VISUAL  244.258 altitude Value 1077
**Goal202    8.011
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1077
   decision Engaged
   decision-altitude 600GOAL202 DIAL SVS NIL Ignore-Autopilot
PROCEDURAL  245.960 SubGoal checking Altitude
VISUAL  246.978 altitude Value 1061
**Goal206    5.026
   isa CHECK-ALTITUDE
   altitude 1061
   previous 1105GOAL206 DIAL SVS NIL Ignore-Altitude
PROCEDURAL  248.635 SubGoal checking Autopilot
VISUAL  249.925 otw_runway Value out-of-sight
VISUAL  250.972 autopilots Value up
VISUAL  251.886 altitude Value 1032
**Goal208    7.926
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1032
   decision Engaged
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   decision-altitude 600GOAL208 DIAL SVS NIL Ignore-Autopilot
PROCEDURAL  253.588 SubGoal checking Altitude
VISUAL  254.686 altitude Value 1015
**Goal212    4.934
   isa CHECK-ALTITUDE
   altitude 1015
   previous 1061GOAL212 DIAL SVS NIL Ignore-Altitude
PROCEDURAL  256.344 SubGoal setting Dial Altitude
VISUAL  257.550 waypoint Value 5
RETRIEVAL  257.700 Altitude 500
VISUAL  258.509 dial-altitude Value 700
MANUAL  261.401 dial-altitude set 500
**Goal214    4.977
   isa DIAL-ALTITUDE
   waypoint 5
   altitude 500GOAL214 SVS DIAL NIL Dial-Altitude
PROCEDURAL  263.007 SubGoal checking Altitude
VISUAL  264.180 altitude Value 906
**Goal218    5.141
   isa CHECK-ALTITUDE
   altitude 906
   previous 1015GOAL218 SVS DIAL NIL Ignore-Altitude
PROCEDURAL  265.837 SubGoal checking Autopilot
VISUAL  266.905 otw_runway Value out-of-sight
VISUAL  268.072 autopilots Value up
VISUAL  268.958 altitude Value 842
**Goal220    7.509
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 842
   decision Engaged
   decision-altitude 600GOAL220 SVS DIAL NIL Ignore-Autopilot
PROCEDURAL  270.659 SubGoal checking Altitude
VISUAL  271.712 altitude Value 805
**Goal224    5.060
   isa CHECK-ALTITUDE
   altitude 805
   previous 906GOAL224 SVS DIAL NIL Ignore-Altitude
PROCEDURAL  273.367 SubGoal setting Dial Altitude
VISUAL  274.218 waypoint Value 5
RETRIEVAL  274.368 Altitude 500
VISUAL  275.568 dial-altitude Value 500
PROCEDURAL  275.618 Confirm Altitude already set to 500
**Goal226    5.048
   isa DIAL-ALTITUDE
   waypoint 5
   altitude 500GOAL226 SVS SVS T Dial-Altitude-Already-Dialed
PROCEDURAL  276.224 SubGoal checking Altitude
VISUAL  277.089 altitude Value 733
**Goal229    4.881
   isa CHECK-ALTITUDE
   altitude 733
   previous 805GOAL229 SVS SVS T Ignore-Altitude
PROCEDURAL  277.745 SubGoal checking Autopilot
VISUAL  278.844 otw_runway Value out-of-sight
VISUAL  280.142 autopilots Value up
VISUAL  281.306 altitude Value 656
```

```
 **Goal231    8.040
    isa SET-AUTOPILOT
    visibility Out-Of-Sight
    peek 656
    decision Engaged
    decision-altitude 600GOAL231 SVS SVS T Ignore-Autopilot
 PROCEDURAL  282.008 SubGoal checking Altitude
 VISUAL  282.810 altitude Value 625
 **Goal235    4.820
    isa CHECK-ALTITUDE
    altitude 625
    previous 733GOAL235 SVS SVS T Ignore-Altitude
 PROCEDURAL  283.465 SubGoal checking Autopilot
 VISUAL  284.529 otw_runway Value out-of-sight
 VISUAL  285.689 autopilots Value up
 VISUAL  286.877 altitude Value 568
 **Goal237    7.745
    isa SET-AUTOPILOT
    visibility Out-Of-Sight
    peek 568
    decision Engaged
    decision-altitude 600GOAL237 SVS SVS T Ignore-Autopilot
 PROCEDURAL  287.579 SubGoal checking Altitude
 VISUAL  288.486 altitude Value 556
 **Goal241    4.991
    isa CHECK-ALTITUDE
    altitude 556
    previous 625GOAL241 SVS SVS T Ignore-Altitude
 PROCEDURAL  292.004 Missed Approach (Altitude below decision
altitude!)
*** Setting ModelDone to 3***

 MCP NAV PFD SVS CONTROLS OTW off Total-time
 28.305511 75.9455 87.99578 35.541256 18.137901 20.361473 25.716827
292.00427
EMC End:T 292.00427

Look 1.0 Action 2.5 Listen 0.5 Ans 0.1


;; Factory is idle.
```

10-SVS IMC Terrain mismatch

```
dribbling to file "NASA-hpm-model-results.drb"

; Fast loading
;    C:\Documents and Settings\bbest\My Documents\Completed
Projects\NASA HEM\NasaHEMv07-Jul-
2005\nasav07\HPMv7\delivery\ole\client\autotool.fasl
;   Fast loading
;      C:\Documents and Settings\bbest\My Documents\Completed
Projects\NASA HEM\NasaHEMv07-Jul-
2005\nasav07\HPMv7\delivery\ole\client\idispatch.fasl
;   Fast loading
;      C:\Documents and Settings\bbest\My Documents\Completed
Projects\NASA HEM\NasaHEMv07-Jul-
2005\nasav07\HPMv7\delivery\ole\client\iclassfactory.fasl

Factory Started
CL-USER(1): (register-server)
Resistered Server EMC_NASAHPM.EMCReceiveCOMMessages
NIL
CL-USER(2):
Subject 0 Trial 0 Run 1
Initializing control

 Control    4.560
    isa CONTROL
    speed 200.0d0
    altitude 2500.0d0
    waypoint nil
    distance nil
    flaps 5
    decision-altitude 600
    landing-gear Up
    airbrakes Off
    autopilots Engaged
    task nil
    last-task nil
    status Active
    landing-checklist nil
 VISUAL    0.000 flaps Value 5
 CHUNK NIL IS UNDEFINED.
 CHUNK NIL IS UNDEFINED.
 PROCEDURAL    3.566 Preparing for approach: engaging Speed-brakes full
 MANUAL    3.566 airbrakes on/off 0
 PROCEDURAL    6.172 Preparing for approach: setting Flaps 1
 MANUAL    6.172 flaps set 1
 PROCEDURAL    7.018 Preparing for approach: setting LNAV
 VISUAL    7.018 distance-next Value 1
 PROCEDURAL    8.055 Preparing for approach: setting VNAV
 VISUAL    8.055 waypoint Value 1
 PROCEDURAL    9.091 Preparing for approach: engaging Autopilot
 VISUAL    9.091 autopilots Value up
 PROCEDURAL    9.248 SubGoal checking Landing Gear
 VISUAL   10.215 waypoint Value 1
 VISUAL   11.523 distance-next Value 0
```

```
RETRIEVAL   11.623 Waypoint 1 Next 0 Distance 15
VISUAL   12.869 landing-gear Value up
PROCEDURAL   12.919 Lowering Gear
MANUAL   15.574 landing-gear up/down 0
**Goal6    8.840
   isa MOVE-GEAR
   waypoint 1
   distance-next 0
   distance 15
   decision DownGOAL6 DIAL DIAL T Move-Gear
PROCEDURAL   16.180 SubGoal checking Altitude
VISUAL   17.385 altitude Value 2500
**Goal11    4.969
   isa CHECK-ALTITUDE
   altitude 2500
   previous 2500.0d0GOAL11 DIAL DIAL T Ignore-Altitude
PROCEDURAL   18.040 SubGoal checking Autopilot
VISUAL   19.302 otw_runway Value out-of-sight
VISUAL   20.466 autopilots Value up
VISUAL   21.311 altitude Value 2500
**Goal13    8.750
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 2500
   decision Engaged
   decision-altitude 600GOAL13 DIAL DIAL T Ignore-Autopilot
PROCEDURAL   22.012 SubGoal checking Speed
VISUAL   23.020 waypoint Value 2
VISUAL   24.205 distance-next Value 3
RETRIEVAL   24.305 Waypoint 2 Next 3 Distance 14
RETRIEVAL   24.455 Speed
VISUAL   25.440 dial-speed Value 200
MANUAL   27.641 dial-speed set 165
**Goal17    5.013
   isa SET-SPEED
   waypoint 2
   distance-next 3
   distance 14
   speed 165GOAL17 SVS SVS T Dial-Speed
PROCEDURAL   28.247 SubGoal checking Speed Brakes
VISUAL   29.407 speed Value 199
VISUAL   30.637 airbrakes Value on
PROCEDURAL   30.687 Setting Speed Brakes
MANUAL   33.285 airbrakes on/off 0
**Goal22    8.346
   isa SPEED-BRAKES
   speed 199
   decision OffGOAL22 DIAL SVS NIL Set-Speed-Brakes
PROCEDURAL   34.885 SubGoal checking Decision Altitude
VISUAL   36.170 waypoint Value 2
VISUAL   37.432 distance-next Value 3
RETRIEVAL   37.532 Waypoint 2 Next 3 Distance 14
**Goal26    5.068
   isa SET-DECISION-ALTITUDE
   waypoint 2
   distance-next 3
   distance 14
```

```
   old 600
   decision 600GOAL26 SVS SVS T Ignore-Decision-Altitude
PROCEDURAL   38.191 SubGoal setting Dial Altitude
VISUAL   39.060 waypoint Value 2
RETRIEVAL   39.210 Altitude 1800
VISUAL   40.351 dial-altitude Value 2500
MANUAL   42.362 dial-altitude set 1800
**Goal29    4.936
   isa DIAL-ALTITUDE
   waypoint 2
   altitude 1800GOAL29 SVS SVS T Dial-Altitude
PROCEDURAL   42.968 SubGoal checking Flaps
VISUAL   44.225 speed Value 187
RETRIEVAL   44.575 Flaps 20
VISUAL   45.327 flaps Value 1
MANUAL   48.382 flaps set 20
**Goal33    5.148
   isa SET-FLAP
   speed 187
   flap 20GOAL33 SVS SVS T Set-Flaps
PROCEDURAL   48.990 SubGoal checking Altitude
VISUAL   50.238 altitude Value 2500
**Goal37    5.126
   isa CHECK-ALTITUDE
   altitude 2500
   previous 2500GOAL37 SVS SVS T Ignore-Altitude
PROCEDURAL   50.894 SubGoal checking Autopilot
VISUAL   51.785 otw_runway Value out-of-sight
VISUAL   52.999 autopilots Value up
VISUAL   54.128 altitude Value 2500
**Goal39    8.209
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 2500
   decision Engaged
   decision-altitude 600GOAL39 SVS SVS T Ignore-Autopilot
PROCEDURAL   54.829 SubGoal checking Landing Gear
VISUAL   55.674 waypoint Value 2
VISUAL   56.755 distance-next Value 1
RETRIEVAL   56.855 Waypoint 2 Next 1 Distance 12
VISUAL   58.004 landing-gear Value down
**Goal43    8.635
   isa MOVE-GEAR
   waypoint 2
   distance-next 1
   distance 12
   decision DownGOAL43 SVS DIAL NIL Decide-Gear
PROCEDURAL   59.604 SubGoal checking Decision Altitude
VISUAL   60.785 waypoint Value 2
VISUAL   61.794 distance-next Value 1
RETRIEVAL   61.894 Waypoint 2 Next 1 Distance 12
**Goal47    5.547
   isa SET-DECISION-ALTITUDE
   waypoint 2
   distance-next 1
   distance 12
   old 600
```

```
   decision 600GOAL47 DIAL DIAL T Ignore-Decision-Altitude
PROCEDURAL   62.552 SubGoal checking Speed
VISUAL   63.474 waypoint Value 2
VISUAL   64.614 distance-next Value 1
RETRIEVAL   64.714 Waypoint 2 Next 1 Distance 12
RETRIEVAL   64.814 Speed
VISUAL   65.707 dial-speed Value 165
MANUAL   67.906 dial-speed set 140
**Goal50    5.180
   isa SET-SPEED
   waypoint 2
   distance-next 1
   distance 12
   speed 140GOAL50 DIAL DIAL T Dial-Speed
PROCEDURAL   68.512 SubGoal setting Dial Altitude
VISUAL   69.690 waypoint Value 2
RETRIEVAL   69.840 Altitude 1800
VISUAL   70.828 dial-altitude Value 1800
PROCEDURAL   70.878 Confirm Altitude already set to 1800
**Goal55    4.533
   isa DIAL-ALTITUDE
   waypoint 2
   altitude 1800GOAL55 SVS DIAL NIL Dial-Altitude-Already-Dialed
PROCEDURAL   72.485 SubGoal checking Speed Brakes
VISUAL   73.595 speed Value 163
VISUAL   74.458 airbrakes Value off
**Goal58    8.574
   isa SPEED-BRAKES
   speed 163
   decision OffGOAL58 SVS SVS T Decide-Speed-Brakes
PROCEDURAL   75.058 SubGoal checking Altitude
VISUAL   76.257 altitude Value 2500
**Goal61    5.031
   isa CHECK-ALTITUDE
   altitude 2500
   previous 2500GOAL61 SVS SVS T Ignore-Altitude
PROCEDURAL   76.912 SubGoal checking Flaps
VISUAL   78.096 speed Value 160
RETRIEVAL   78.246 Flaps 15
VISUAL   79.280 flaps Value 20
MANUAL   81.394 flaps set 15
VISUAL   81.394 atc Value random-listen
CHUNK NIL IS UNDEFINED.
CHUNK NIL IS UNDEFINED.
**Goal63    5.170
   isa SET-FLAP
   speed 160
   flap 15GOAL63 SVS SVS T Set-Flaps
PROCEDURAL   82.001 SubGoal checking Decision Altitude
VISUAL   82.863 waypoint Value 2
VISUAL   84.071 distance-next Value 0
RETRIEVAL   84.171 Waypoint 2 Next 0 Distance 11
**Goal67    4.824
   isa SET-DECISION-ALTITUDE
   waypoint 2
   distance-next 0
   distance 11
```

```
   old 600
   decision 600GOAL67 DIAL SVS NIL Ignore-Decision-Altitude
PROCEDURAL   85.827 SubGoal checking Autopilot
VISUAL   87.117 atc Value ten-miles-out
VISUAL   87.117 otw_runway Value out-of-sight
VISUAL   87.964 autopilots Value up
VISUAL   88.986 altitude Value 2420
**Goal70    8.767
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 2420
   decision Engaged
   decision-altitude 600GOAL70 DIAL SVS NIL Ignore-Autopilot
PROCEDURAL   90.687 SubGoal checking Speed Brakes
VISUAL   91.816 speed Value 157
VISUAL   92.926 airbrakes Value off
**Goal74    8.376
   isa SPEED-BRAKES
   speed 157
   decision OffGOAL74 SVS DIAL NIL Decide-Speed-Brakes
PROCEDURAL   94.526 SubGoal setting Dial Altitude
VISUAL   95.371 waypoint Value 3
RETRIEVAL   95.521 Altitude 1000
VISUAL   96.596 dial-altitude Value 1800
MANUAL   98.853 dial-altitude set 1000
**Goal77    4.823
   isa DIAL-ALTITUDE
   waypoint 3
   altitude 1000GOAL77 SVS SVS T Dial-Altitude
PROCEDURAL   99.459 SubGoal checking Landing Gear
VISUAL  100.664 waypoint Value 3
VISUAL  101.915 distance-next Value 1
RETRIEVAL  102.015 Waypoint 3 Next 1 Distance 10
VISUAL  103.012 landing-gear Value down
**Goal81    8.203
   isa MOVE-GEAR
   waypoint 3
   distance-next 1
   distance 10
   decision DownGOAL81 SVS SVS T Decide-Gear
PROCEDURAL  103.612 SubGoal checking Altitude
VISUAL  104.693 altitude Value 2147
**Goal85    5.153
   isa CHECK-ALTITUDE
   altitude 2147
   previous 2500GOAL85 SVS SVS T Read-Altitude
PROCEDURAL  105.351 SubGoal checking Speed
VISUAL  106.208 waypoint Value 3
VISUAL  107.550 distance-next Value 1
RETRIEVAL  107.650 Waypoint 3 Next 1 Distance 10
RETRIEVAL  107.750 Speed
VISUAL  108.832 dial-speed Value 140
PROCEDURAL  108.882 Confirm Speed already set to 140
**Goal87    5.233
   isa SET-SPEED
   waypoint 3
   distance-next 1
```

```
   distance 10
   speed 140GOAL87 SVS SVS T Speed-Already-Dialed
PROCEDURAL  109.490 SubGoal checking Autopilot
VISUAL  110.530 otw_runway Value out-of-sight
VISUAL  111.368 autopilots Value up
VISUAL  112.422 altitude Value 2015
**Goal91    8.551
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 2015
   decision Engaged
   decision-altitude 600GOAL91 SVS SVS T Ignore-Autopilot
PROCEDURAL  113.123 SubGoal checking Decision Altitude
VISUAL  114.040 waypoint Value 3
VISUAL  114.969 distance-next Value 0
RETRIEVAL  115.069 Waypoint 3 Next 0 Distance 9
**Goal95    5.050
   isa SET-DECISION-ALTITUDE
   waypoint 3
   distance-next 0
   distance 9
   old 600
   decision 600GOAL95 SVS SVS T Ignore-Decision-Altitude
PROCEDURAL  115.725 SubGoal checking Flaps
VISUAL  116.900 speed Value 151
RETRIEVAL  117.050 Flaps 25
VISUAL  118.286 flaps Value 15
MANUAL  120.508 flaps set 25
**Goal98    5.270
   isa SET-FLAP
   speed 151
   flap 25GOAL98 SVS SVS T Set-Flaps
PROCEDURAL  121.116 SubGoal checking Altitude
VISUAL  122.375 altitude Value 1846
**Goal102    5.165
   isa CHECK-ALTITUDE
   altitude 1846
   previous 2147GOAL102 SVS SVS T Read-Altitude
PROCEDURAL  123.031 SubGoal setting Dial Altitude
VISUAL  124.313 waypoint Value 3
RETRIEVAL  124.463 Altitude 1000
VISUAL  125.645 dial-altitude Value 1000
PROCEDURAL  125.695 Confirm Altitude already set to 1000
**Goal104    5.024
   isa DIAL-ALTITUDE
   waypoint 3
   altitude 1000GOAL104 DIAL SVS NIL Dial-Altitude-Already-Dialed
PROCEDURAL  127.301 SubGoal checking Altitude
VISUAL  128.510 altitude Value 1779
**Goal107    4.959
   isa CHECK-ALTITUDE
   altitude 1779
   previous 1846GOAL107 DIAL SVS NIL Ignore-Altitude
PROCEDURAL  130.167 SubGoal checking Autopilot
VISUAL  130.974 otw_runway Value out-of-sight
VISUAL  131.863 autopilots Value up
VISUAL  133.053 altitude Value 1750
```

```
**Goal109    8.267
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1750
   decision Engaged
   decision-altitude 600GOAL109 DIAL SVS NIL Ignore-Autopilot
PROCEDURAL  134.754 SubGoal checking Altitude
VISUAL  135.780 altitude Value 1733
**Goal113    4.987
   isa CHECK-ALTITUDE
   altitude 1733
   previous 1779GOAL113 DIAL SVS NIL Ignore-Altitude
PROCEDURAL  137.436 SubGoal setting Dial Altitude
VISUAL  138.545 waypoint Value 4
RETRIEVAL  138.696 Altitude 700
VISUAL  139.698 dial-altitude Value 1000
MANUAL  142.840 dial-altitude set 700
**Goal115    5.193
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL115 SVS DIAL NIL Dial-Altitude
PROCEDURAL  144.448 SubGoal completing landing checklist
PROCEDURAL  147.484 Landing checklist: setting Gear down 1
MANUAL  147.484 landing-gear up/down 0
PROCEDURAL  150.278 Landing checklist: setting Speed to 135
MANUAL  150.278 speed set 135
VISUAL  150.278 speed Value 145
CHUNK NIL IS UNDEFINED.
CHUNK NIL IS UNDEFINED.
PROCEDURAL  154.408 Landing checklist: setting Speed-brakes to armed
MANUAL  154.408 airbrakes on/off 0
PROCEDURAL  157.378 Landing checklist: setting Flaps 15
MANUAL  157.378 flaps set 15
PROCEDURAL  159.385 Landing checklist: preparing cabin for landing
VOCAL  159.385 nothing communication 2007
VISUAL  159.385 atc Value random-listen
Warning: Unknown Comm Type RANDOM-LISTEN
AURAL  161.392 ATC message Random-Listen
VOCAL  161.392 atc communication 2007
PROCEDURAL  161.550 SubGoal checking Altitude
VISUAL  162.394 altitude Value 1569
**Goal127    5.059
   isa CHECK-ALTITUDE
   altitude 1569
   previous 1733GOAL127 SVS DIAL NIL Read-Altitude
PROCEDURAL  164.051 SubGoal checking Autopilot
VISUAL  165.060 otw_runway Value out-of-sight
VISUAL  166.137 autopilots Value up
VISUAL  167.173 altitude Value 1540
**Goal129    8.277
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1540
   decision Engaged
   decision-altitude 600GOAL129 SVS DIAL NIL Ignore-Autopilot
PROCEDURAL  168.875 SubGoal checking Altitude
VISUAL  169.982 altitude Value 1523
```

```
**Goal133    5.082
   isa CHECK-ALTITUDE
   altitude 1523
   previous 1569GOAL133 SVS DIAL NIL Ignore-Altitude
PROCEDURAL  171.638 SubGoal checking Autopilot
VISUAL  172.715 otw_runway Value out-of-sight
VISUAL  173.827 autopilots Value up
VISUAL  175.126 altitude Value 1492
**Goal135    7.561
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1492
   decision Engaged
   decision-altitude 600GOAL135 SVS DIAL NIL Ignore-Autopilot
PROCEDURAL  176.827 SubGoal checking Altitude
VISUAL  178.004 altitude Value 1475
**Goal139    4.909
   isa CHECK-ALTITUDE
   altitude 1475
   previous 1523GOAL139 SVS DIAL NIL Ignore-Altitude
PROCEDURAL  179.664 SubGoal setting Dial Altitude
VISUAL  180.469 waypoint Value 4
RETRIEVAL  180.619 Altitude 700
VISUAL  181.395 dial-altitude Value 700
PROCEDURAL  181.445 Confirm Altitude already set to 700
**Goal141    5.373
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL141 DIAL SVS NIL Dial-Altitude-Already-Dialed
PROCEDURAL  183.051 SubGoal checking Altitude
VISUAL  183.888 altitude Value 1440
**Goal144    5.310
   isa CHECK-ALTITUDE
   altitude 1440
   previous 1475GOAL144 DIAL SVS NIL Ignore-Altitude
PROCEDURAL  185.546 SubGoal checking Autopilot
VISUAL  186.642 otw_runway Value out-of-sight
VISUAL  187.622 autopilots Value up
VISUAL  188.766 altitude Value 1411
**Goal146    8.041
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1411
   decision Engaged
   decision-altitude 600GOAL146 DIAL SVS NIL Ignore-Autopilot
PROCEDURAL  190.467 SubGoal checking Altitude
VISUAL  191.643 altitude Value 1393
**Goal150    4.800
   isa CHECK-ALTITUDE
   altitude 1393
   previous 1440GOAL150 DIAL SVS NIL Ignore-Altitude
PROCEDURAL  193.300 SubGoal setting Dial Altitude
VISUAL  194.176 waypoint Value 4
RETRIEVAL  194.326 Altitude 700
VISUAL  195.444 dial-altitude Value 700
PROCEDURAL  195.494 Confirm Altitude already set to 700
**Goal152    5.112
```

```
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL152 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  196.102 SubGoal checking Altitude
VISUAL  197.041 altitude Value 1361
**Goal155    4.877
   isa CHECK-ALTITUDE
   altitude 1361
   previous 1393GOAL155 DIAL DIAL T Ignore-Altitude
PROCEDURAL  197.697 SubGoal setting Dial Altitude
VISUAL  198.724 waypoint Value 4
RETRIEVAL  198.874 Altitude 700
VISUAL  200.103 dial-altitude Value 700
PROCEDURAL  200.153 Confirm Altitude already set to 700
**Goal157    4.930
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL157 SVS DIAL NIL Dial-Altitude-Already-Dialed
PROCEDURAL  201.759 SubGoal checking Altitude
VISUAL  202.893 altitude Value 1326
**Goal160    4.851
   isa CHECK-ALTITUDE
   altitude 1326
   previous 1361GOAL160 SVS DIAL NIL Ignore-Altitude
PROCEDURAL  204.549 SubGoal setting Dial Altitude
VISUAL  205.484 waypoint Value 4
RETRIEVAL  205.634 Altitude 700
VISUAL  206.475 dial-altitude Value 700
PROCEDURAL  206.525 Confirm Altitude already set to 700
**Goal162    5.026
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL162 DIAL SVS NIL Dial-Altitude-Already-Dialed
PROCEDURAL  208.130 SubGoal checking Altitude
VISUAL  208.977 altitude Value 1290
**Goal165    4.993
   isa CHECK-ALTITUDE
   altitude 1290
   previous 1326GOAL165 DIAL SVS NIL Ignore-Altitude
PROCEDURAL  210.634 SubGoal checking Autopilot
VISUAL  211.855 otw_runway Value out-of-sight
VISUAL  212.770 autopilots Value up
VISUAL  213.656 altitude Value 1262
**Goal167    7.926
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 1262
   decision Engaged
   decision-altitude 600GOAL167 DIAL SVS NIL Ignore-Autopilot
PROCEDURAL  215.357 SubGoal setting Dial Altitude
VISUAL  216.499 waypoint Value 4
RETRIEVAL  216.649 Altitude 700
VISUAL  217.482 dial-altitude Value 700
PROCEDURAL  217.532 Confirm Altitude already set to 700
**Goal171    5.037
   isa DIAL-ALTITUDE
   waypoint 4
```

```
   altitude 700GOAL171 SVS DIAL NIL Dial-Altitude-Already-Dialed
PROCEDURAL  219.139 SubGoal checking Altitude
VISUAL  220.424 altitude Value 1222
**Goal174    4.829
   isa CHECK-ALTITUDE
   altitude 1222
   previous 1290GOAL174 SVS DIAL NIL Ignore-Altitude
PROCEDURAL  222.082 SubGoal completing landing checklist
PROCEDURAL  225.379 Landing checklist: setting Speed-brakes to armed
MANUAL  225.379 airbrakes on/off 0
PROCEDURAL  228.176 Landing checklist: setting Speed to 135
MANUAL  228.176 speed set 135
VISUAL  228.176 speed Value 140
PROCEDURAL  231.242 Landing checklist: preparing cabin for landing
VOCAL  231.242 nothing communication 2007
PROCEDURAL  233.665 Landing checklist: setting Flaps 15
MANUAL  233.665 flaps set 15
PROCEDURAL  235.853 Landing checklist: setting Gear down 1
MANUAL  235.853 landing-gear up/down 0
VOCAL  235.903 Landing Checklist Complete
PROCEDURAL  236.059 SubGoal checking Altitude
VISUAL  237.003 altitude Value 1123
**Goal183    4.924
   isa CHECK-ALTITUDE
   altitude 1123
   previous 1222GOAL183 SVS DIAL NIL Ignore-Altitude
PROCEDURAL  238.659 SubGoal setting Dial Altitude
VISUAL  239.846 atc Value random-listen
VISUAL  239.846 waypoint Value 4
RETRIEVAL  239.996 Altitude 700
VISUAL  241.165 dial-altitude Value 700
PROCEDURAL  241.215 Confirm Altitude already set to 700
**Goal185    4.837
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL185 DIAL SVS NIL Dial-Altitude-Already-Dialed
PROCEDURAL  242.824 SubGoal checking Altitude
VISUAL  244.049 altitude Value 1080
**Goal188    4.669
   isa CHECK-ALTITUDE
   altitude 1080
   previous 1123GOAL188 DIAL SVS NIL Ignore-Altitude
PROCEDURAL  245.705 SubGoal setting Dial Altitude
VISUAL  246.621 waypoint Value 4
RETRIEVAL  246.771 Altitude 700
VISUAL  247.824 dial-altitude Value 700
PROCEDURAL  247.874 Confirm Altitude already set to 700
**Goal190    4.877
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL190 DIAL DIAL T Dial-Altitude-Already-Dialed
PROCEDURAL  248.481 SubGoal checking Altitude
VISUAL  249.528 altitude Value 1048
**Goal193    4.738
   isa CHECK-ALTITUDE
   altitude 1048
   previous 1080GOAL193 DIAL DIAL T Ignore-Altitude
```

```
PROCEDURAL  250.185 SubGoal setting Dial Altitude
VISUAL  251.378 waypoint Value 4
RETRIEVAL  251.528 Altitude 700
VISUAL  252.322 dial-altitude Value 700
PROCEDURAL  252.372 Confirm Altitude already set to 700
**Goal195    5.511
   isa DIAL-ALTITUDE
   waypoint 4
   altitude 700GOAL195 SVS DIAL NIL Dial-Altitude-Already-Dialed
PROCEDURAL  253.979 SubGoal checking Altitude
VISUAL  254.898 altitude Value 1016
**Goal198    5.309
   isa CHECK-ALTITUDE
   altitude 1016
   previous 1048GOAL198 SVS DIAL NIL Ignore-Altitude
PROCEDURAL  256.553 SubGoal checking Autopilot
VISUAL  257.359 otw_runway Value out-of-sight
VISUAL  258.435 autopilots Value up
VISUAL  259.592 altitude Value 972
**Goal200    7.906
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 972
   decision Engaged
   decision-altitude 600GOAL200 SVS DIAL NIL Ignore-Autopilot
PROCEDURAL  261.293 SubGoal checking Altitude
VISUAL  262.366 altitude Value 935
**Goal204    5.047
   isa CHECK-ALTITUDE
   altitude 935
   previous 1016GOAL204 SVS DIAL NIL Ignore-Altitude
PROCEDURAL  264.024 SubGoal setting Dial Altitude
VISUAL  264.867 waypoint Value 5
RETRIEVAL  265.017 Altitude 500
VISUAL  265.915 dial-altitude Value 700
MANUAL  268.181 dial-altitude set 500
**Goal206    5.075
   isa DIAL-ALTITUDE
   waypoint 5
   altitude 500GOAL206 SVS SVS T Dial-Altitude
PROCEDURAL  268.787 SubGoal checking Altitude
VISUAL  269.971 altitude Value 833
**Goal210    4.889
   isa CHECK-ALTITUDE
   altitude 833
   previous 935GOAL210 SVS SVS T Ignore-Altitude
PROCEDURAL  270.628 SubGoal checking Autopilot
VISUAL  271.780 otw_runway Value out-of-sight
VISUAL  272.799 autopilots Value up
VISUAL  273.820 altitude Value 782
**Goal212    7.869
   isa SET-AUTOPILOT
   visibility Out-Of-Sight
   peek 782
   decision Engaged
   decision-altitude 600GOAL212 SVS SVS T Ignore-Autopilot
PROCEDURAL  274.521 SubGoal checking Altitude
```

```
 VISUAL  275.370 altitude Value 760
 **Goal216    5.182
    isa CHECK-ALTITUDE
    altitude 760
    previous 833GOAL216 SVS SVS T Ignore-Altitude
 PROCEDURAL  276.026 SubGoal checking Autopilot
 VISUAL  276.913 otw_runway Value out-of-sight
 VISUAL  277.823 autopilots Value up
 VISUAL  279.024 altitude Value 712
 **Goal218    8.074
    isa SET-AUTOPILOT
    visibility Out-Of-Sight
    peek 712
    decision Engaged
    decision-altitude 600GOAL218 SVS SVS T Ignore-Autopilot
 PROCEDURAL  279.725 SubGoal checking Altitude
 VISUAL  280.621 altitude Value 681
 **Goal222    4.857
    isa CHECK-ALTITUDE
    altitude 681
    previous 760GOAL222 SVS SVS T Ignore-Altitude
 PROCEDURAL  281.277 SubGoal checking Autopilot
 VISUAL  282.496 otw_runway Value runway-off-alignment
 VISUAL  283.705 autopilots Value up
 PROCEDURAL  283.755 Runway misaligned -- going around
 MANUAL  286.389 autopilots up/down 0
 VISUAL  287.556 altitude Value 565
 **Goal224    9.970
    isa SET-AUTOPILOT
    visibility Runway-Off-Alignment
    peek 565
    decision Disengaged
    decision-altitude 600GOAL224 SVS SVS T Read-Peek


*** Finis  ***


*** Setting ModelDone to 1***

 MCP NAV PFD SVS CONTROLS OTW off Total-time
 31.59862 78.29949 77.74814 26.944912 29.807095 32.23547 11.5224
288.15613
EMC End:T 288.15613

Look 1.0 Action 2.5 Listen 0.5 Ans 0.1


;; Factory is idle.
```

Appendix C – ACT-R Approach Model

```
;;;  ACT-R Model

(defparameter *svs-present* t)  ;; set to true when svs is enabled
(dribble "NASA-hpm-model-results.drb")

;;; Areas of interest for validation with eye-tracking data
(initialized to 0 seconds of viewing)
;;; Model revised on 7/1/05 to correct PFD dwells -- altitude and speed
were wrongly assigned to MCP
(defparameter *MCP-dwell* 0)       ;; mode control panel -- speed dial,
altitude dial
(defparameter *NAV-dwell* 0)       ;; navigation display -- not used in
this model
(defparameter *PFD-dwell* 0)       ;; primary flight display --
decision height, altitude, autopilot
(defparameter *SVS-dwell* 0)       ;; synthetic vision display
(defparameter *CONTROLS-dwell* 0)  ;; controls
(defparameter *OTW-dwell* 0)       ;; out the window

(defparameter *mark* 0)  ;; used to mark the point in time where a
watching incident starts

(defun display-dwell-times ()
  (let* ((total-time (actr-time))
         (off-time (- total-time (+ *MCP-dwell* *NAV-dwell* *PFD-dwell*
*SVS-dwell* *CONTROLS-dwell* *OTW-dwell*))))
    (format t "~%~TMCP~TNAV~TPFD~TSVS~TCONTROLS~TOTW~Toff~TTotal-time")
    (format t "~%~T~s~T~s~T~s~T~s~T~s~T~s~T~s~T~s~T~s~%" *MCP-dwell* *NAV-
dwell* *PFD-dwell*
      *SVS-dwell* *CONTROLS-dwell* *OTW-dwell* off-time total-time)))

;;; Learning
;;; Generalization of ACT-R 5.0 learning to multiple goals
;;; All learning is goal-specific, but no discounting for subgoals
;;; This makes sense given no goal stack and is plausible in a number
of ways
;;; *previous-instantiations* is now an a-list indexed by goal
;;; Need to remove the length of time spent in the other goals?

(defparameter *goal* nil)

(defun learn-parameters (success failure &key (latency 0.0)
(instantiation *instantiation*))
  "Applies the parameters learning equations to instantiation.  The
success and/or
   failure of the goal has already been determined and is passed along
with the latency
   of this instantiation and the instantiation itself (if it exists)."
  (let ((production (when instantiation (instantiation-production
instantiation)))
        (previous-instantiations (assoc *goal* *previous-
instantiations*)))
    (unless previous-instantiations
```

```
      (setf previous-instantiations (list *goal*))
      (push previous-instantiations *previous-instantiations*))
    (cond ((and success failure)  ;; clear the history
           (setf *previous-instantiations*
                 (delete previous-instantiations *previous-
instantiations*)))
          ((or success failure)  ;; register success or failure for all
productions
           (when production
             (push (cons production (- *time* latency)) (rest previous-
instantiations)))
           (dolist (production-time (rest previous-instantiations))
             (let* ((previous-production (car production-time))
                    (previous-time (cdr production-time))
                    (effort (- *time* previous-time)))
               (add-reference (if success (production-successes
previous-production)
                                  (production-failures previous-
production))
                              (not (numberp *parameters-learning*))
                              1.0 previous-time)
               (add-reference (production-efforts previous-production)
                              (not (numberp *parameters-learning*))
                              1.0 effort)
               (recompute-production-parameters previous-production)))
           (setf *previous-instantiations*
                 (delete previous-instantiations *previous-
instantiations*)))
          (t  ;; simply add the production
           (when production
             (push (cons production (- *time* latency)) (rest previous-
instantiations)))))))

;;; The robust version sets the global variables in productions (or
hooks)
;;; rather than in wrapping code, which is too model-specific

(defparameter *task-history* nil)

(defparameter *source-history* nil)

(defparameter *window* '(5 5 5 40 40 40 40 5))

(defun select-task-success ()
  (not (select-task-failure)))

(defun select-task-failure ()
  (let* ((task (first *task-history*))
         (index (chunk-slot-value-fct task 'number)))
    (member task (subseq *task-history* 0
                         (min (if (numberp *window*) *window*
                                  (nth (1- index) *window*))
                              (length *task-history*))))))

(defun task-effort ()
  (let ((new-source (first *source-history*))
        (old-source (second *source-history*)))
```

```
;;;     (break)
    (format t "~S ~S ~S ~S ~S~%"
            (goal-focus) new-source old-source
            (eq new-source old-source)
            (first (first (rest (assoc *goal* *previous-
instantiations*)))))
    (if (eq new-source old-source) 0.5 1.5)))

(defun set-globals (instantiation)
  "Sets the global variables as a function of instantiation."
  (setf *goal* *wmfocus*)
  (let ((production (production-name (instantiation-production
instantiation))))
    (case production
      (DO-SET-FLAP (push 'flap *task-history*))
      (DO-SET-ALTITUDE (push 'altitude *task-history*))
      (DO-SET-SPEED (push 'speed *task-history*))
      (DO-GEAR-DOWN (push 'gear *task-history*))
      (DO-SPEED-BRAKES-ON (push 'brakes *task-history*))
      (DO-SET-DECISION-ALTITUDE (push 'decision *task-history*))
      (DO-SET-AUTOPILOT (push 'autopilot *task-history*))
      (DO-CHECK-ALTITUDE (push 'altimeter *task-history*))
      ((get-speed-dial get-waypoint-dial get-distance-next-dial)
       (push 'dial *source-history*))
      ((get-speed-svs get-waypoint-svs get-distance-next-svs)
       (push 'svs *source-history*))
      (t)))
  )

;;; Handling of the task

(defvar *landings* 0)                ;Count of landings
(defparameter *look-delay* 0.5)
(defparameter *action-delay* 1.5)
(defparameter *listen-delay* 0.5)
(defparameter *dat* 0.05)
(defparameter *ans* 0.1)
      ;10 minutes

(defun actr-time-sd (time)
  (actr-time-fct (* time (+ 0.75 (random 0.5)))))

(defun chatter (type)
  ;; Advances time and produces return code.
  (case type
    (2000 (actr-time-sd (* *listen-delay* 2.0)) 2005)
    (2001 (actr-time-sd (* *listen-delay* 5.0)) 2004)
    (2002 (actr-time-sd *listen-delay*)  2002)
    (2003 (actr-time-sd (* *listen-delay* 3.0)) 2003)
    (otherwise (warn "Unknown Comm Type ~a" type) 2007)))

(defun initialize-control (&key (speed 200) (altitude 25000)(flaps 5))
  (setq *look* nil) (setq *action* nil)
  (add-dm-fct `((control isa control
                  speed ,speed altitude ,altitude  flaps ,flaps
                  landing-gear up airbrakes off autopilots engaged
                  decision-altitude 600
```

```
                    task nil
)))
;;  (goal-focus control)
  (when (and *output-trace* *verbose*)
    (format *output-trace* "~&Initializing control~% ")
    (dm control)))
(defparameter *set-waypoint-instances*
    '((1 15) (2 11) (3 9) (4 3) (5 2)(6 0)))

;;; Code to automatically generate instances given arrays of data

(defun generate-instances (type slots values-list)
  (let ((chunks nil))
    (dolist (values values-list)
      (let ((name (symbol-name type)))
        (dolist (value values)
          (setf name (concatenate 'string name "-" (format nil "~D"
value))))
        (let ((chunk (list (intern name) 'isa type)))
          (dolist (slot slots)
            (push-last slot chunk)
            (push-last (pop values) chunk))
          (push-last chunk chunks))))
    (add-dm-fct chunks)))

(defparameter *set-flap-instances*
  '((125 30)
    (145 20)
    (145 30)
    (165 15)
    (165 25)
    (185 5)
    (185 25)
    (195 1)
    (195 20)
    (205 1)
    (205 15)
    (210 0)
    (210 15)
    (220 0)
    (220 5)
    (240 0)
    (240 1)))

;; waypoint vs altitude instances for final approach and landing
(defparameter *dial-altitude-instances*
    '((1 2500)
      (2 1800)
      (3 1000)
      (4 700)
      (5 500))) ;Uses next waypoint (12/2/02)

;; distance vs speed instances for final approach and landing
(defparameter *set-speed-instances*
  '((60 160)
    (15 160)
    (13 165)  ;;speed plus 5 when gear and flaps are deployed
```

```
    (12 140)
    (5  125)
    (0  117)
     ))

(defun number-ratio-similarities (x y)
  "Defines ratio similarities between numbers.  It generally makes
sense
   given the scales involved which are on widely different orders.
   But how to deal with 0?  Let's accept full dissimilarity, i.e. flaps
off
   or being on the ground is fundamentally different from other
values."
  ;;; if not numbers, defaults to chunk similarities
  (when (and (numberp x) (numberp y))
    ;;; Need to handle the x=y=0 case separately
    (if (and (zerop x) (zerop y)) 1.0
        ;;; similarity computations like floats better
        ;;; min/max produces the [0,1] similarity scale
      (coerce (/ (min x y) (max x y)) 'float))))

(defvar *look* nil)

(defun look (arguments)
  (actr-time-sd *look-delay*)
  (let ((chunk (create-buffer-chunk arguments)))
    ;;; always returns 200 for simplicity
    ;;;(mod-chunk-fct chunk (list 'setting 200))  ;;; this default
value caused problems when Imprint didn't return value
   )
  (setq *stop* t)
  )

(defvar *action* nil)

(defun action (arguments)
  (actr-time-sd *action-delay*)
  (create-buffer-chunk arguments)
  (setq *stop* t)
  )

(clear-all)

(setf *firing-hook-fn* 'set-globals)

;;; Parameters

;;; Need to turn on blending for instance-based control?
;;; Then the options need to be narrowed to avoid generating all
numbers

(sgp :era t :pm t :mp 5.0 :blc 5.0 :v t :ct nil :lt nil  ;;; turn off
traces
     :ut nil  ;;; always picks something
     :rt -5.0 ;;; always retrieves
     :pl 0.5  ;;; turn on parameters learning
     :egs 0.25)  ;;; turn on selection noise
```

```
(sgp-fct (list :ans *ans* :dat *dat*))


;;; Add a buffer called look for getting external information

(chunk-type look setting where source)

;;; Add an action buffer for setting external information

(chunk-type action what do setting)


;;; Separate instance chunk types for each control mapping
;;; It makes sense because they all represent different domains
;;; Practically, it helps avoid interference between different types

;;; Supertypes for reading distance and speed

(chunk-type speed-decision speed)
(chunk-type waypoint-decision waypoint)
;;;Distance is to waypoint for distance to runway calculate
(chunk-type (distance-decision (:include waypoint-decision))
          distance-next distance)


;;; Waypoints used to calculate distance to runway
(chunk-type waypoint id range)

;;; Set flaps based on speed
(chunk-type (set-flap (:include speed-decision))  flap)

;;; Dial altitude based on distance
(chunk-type (dial-altitude (:include waypoint-decision)) altitude)

;;; Set speed based on distance
(chunk-type (set-speed (:include distance-decision)) speed)

;;; Put gear down at right distance
(chunk-type (move-gear (:include distance-decision)) decision)

;;; Put speed brakes on at right speed
(chunk-type (speed-brakes (:include speed-decision)) decision)

;;; Set decision altitude at right distance
(chunk-type (set-decision-altitude (:include distance-decision))
          old decision)

;;; Set autopilot based on runway visibility
(chunk-type set-autopilot visibility peek decision decision-altitude)

;;; Occasionally look at altimeter
(chunk-type check-altitude altitude previous)

;;; Prepare for approach
(chunk-type approach lnav vnav autopilot speed-brakes flaps status)
```

```
;;; Landing checklist
(chunk-type landing-checklist gear speed-brakes flaps speed cabin
status)

;;; Communications
(chunk-type communication chatter)

;;; Top-level control goal
(chunk-type control speed altitude waypoint distance flaps decision-
altitude
          landing-gear airbrakes autopilots task last-task (status
active) landing-checklist)

;;; Tasks and Sources
(chunk-type index number)

(chunk-type (task (:include index)))

(chunk-type (source (:include index)))


;;; Constant chunks
(add-dm
 (up isa chunk)
 (down isa chunk)
 (on isa chunk)
 (off isa chunk)
 (yes isa chunk)
;;; (speed isa chunk)
 ;;; add the tasks and sources
 (flap isa task number 1)
 (altitude isa task number 2)
 (speed isa task number 3)
 (gear isa task number 4)
 (brakes isa task number 5)
 (decision isa task number 6)
 (autopilot isa task number 7)
 (altimeter isa task number 8)
 (dial isa source number 1)
 (svs isa source number 2)
 )

;;; Generating instances

(generate-instances 'set-flap '(speed flap) *set-flap-instances*)

(generate-instances 'dial-altitude '(waypoint altitude)
                *dial-altitude-instances*)

(generate-instances 'set-speed '(distance speed)  *set-speed-
instances*)

(generate-instances 'waypoint '(id range) *set-waypoint-instances*)

;;; Set ratio similarities between numbers

(setf *similarity-hook-fn* #'number-ratio-similarities)
```

```
;;; Define modular look and act buffers
(define-buffer look *look*
  :plus-rhs look)

(define-buffer action *action*
  :plus-rhs action)

;;; Initialize system to the approach checklist for the scenario
(add-dm (approach-checklist isa approach))
(goal-focus approach-checklist)

;;; Productions

;;; Top-level productions
;;; Looking is an action. We must halt and give IMPRINT a turn.
;;;  Control needs to be initialized.

;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;; Control
;;;   Constant monitoring: speed, altitude, flaps
;;;   Set points followed by monitoring: gear, speed brakes, decision
altitude, autopilot
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;

(p do-landing-checklist
   =goal>
      isa         control
      task        nil
      >= waypoint 4
      landing-checklist nil
==>
   =goal>
      task        landing-checklist
   +goal>
      isa         landing-checklist
   !output! "PROCEDURAL ~8,3F SubGoal completing landing checklist~%"
(actr-time)
   !eval! (setf *mark* (actr-time))
)

(p do-check-altitude
   =goal>
      isa         control
      task        nil
      - last-task check-altitude
      altitude    =previous
==>
   =goal>
      task        check-altitude
   +goal>
      isa         check-altitude
      previous    =previous
   !output! "PROCEDURAL ~8,3F SubGoal checking Altitude~%" (actr-time)
   !eval! (setf *mark* (actr-time))
```

```
)

(p do-set-flap
   =goal>
      isa         control
      task        nil
      - last-task set-flap
      autopilots  engaged
      >= altitude 2000     ;; don't bother during final approach
==>
   =goal>
      task        set-flap
   +goal>
      isa         set-flap
   !output! "PROCEDURAL ~8,3F SubGoal checking Flaps~%" (actr-time)
   !eval! (setf *mark* (actr-time))
)

(p do-set-altitude
   =goal>
      isa         control
      task        nil
      - last-task dial-altitude
      >= altitude 750     ;; don't bother during final approach
==>
   =goal>
      task        dial-altitude
   +goal>
      isa         dial-altitude
   !output! "PROCEDURAL ~8,3F SubGoal setting Dial Altitude~%" (actr-
time)
   !eval! (setf *mark* (actr-time))
)

(p do-set-speed
   =goal>
     isa          control
     task         nil
     - last-task set-speed
     >= altitude 2000     ;; don't bother during final approach
==>
   =goal>
      task        set-speed
   +goal>
      isa         set-speed
   !output! "PROCEDURAL ~8,3F SubGoal checking Speed~%" (actr-time)
   !eval! (setf *mark* (actr-time))
)

(p do-gear-down
   =goal>
      isa         control
      task        nil
      - last-task move-gear
      >= altitude 2000     ;; don't bother during final approach
==>
   =goal>
```

```
      task         move-gear
   +goal>
      isa          move-gear
   !output! "PROCEDURAL ~8,3F SubGoal checking Landing Gear~%" (actr-
time)
   !eval! (setf *mark* (actr-time))
)

(p do-speed-brakes-on
   =goal>
      isa          control
      task         nil
      - last-task speed-brakes
      >= altitude 2000    ;; speed brakes should be armed by 12 miles
out, > 2000 ft
==>
   =goal>
      task         speed-brakes
   +goal>
      isa          speed-brakes
   !output! "PROCEDURAL ~8,3F SubGoal checking Speed Brakes~%" (actr-
time)
   !eval! (setf *mark* (actr-time))
)

;;; do not forget to pass the old decision altitude

(p do-set-decision-altitude
   =goal>
      isa          control
      task         nil
      - last-task set-decision-altitude
      decision-altitude =old
      >= altitude 2000                    ;;decision altitude is set
by 2000 ft/11 miles out
 ==>
   =goal>
      task         set-decision-altitude
   +goal>
      isa          set-decision-altitude
      old               =old
   !output! "PROCEDURAL ~8,3F SubGoal checking Decision Altitude~%"
(actr-time)
   !eval! (setf *mark* (actr-time))
)

(p do-set-autopilot
   =goal>
      isa          control
      task         nil
      - last-task set-autopilot
      decision-altitude =decision-altitude
==>
   =goal>
      task         set-autopilot
   +goal>
      isa          set-autopilot
```

```
      decision-altitude =decision-altitude
   !output! "PROCEDURAL ~8,3F SubGoal checking Autopilot~%" (actr-time)
   !eval! (setf *mark* (actr-time))
)


(p missed-approach
   =goal>
      isa         control
      task        nil
      decision-altitude =decision-altitude
      altitude =altitude
   !eval! (< =altitude (- =decision-altitude 25))  ;; below decision
altitude
==>
   +action>
      isa         action
      what        ATC
      do          Communication
      setting     Go-Around
   !output! "PROCEDURAL ~8,3F Missed Approach (Altitude below decision
altitude!)" (actr-time)
   !eval! (signal-done 3)
   !eval! (display-dwell-times)
)


(p finis
   =goal>
      isa         control
      - task            nil
      autopilots  disengaged
      ==>
   !output! "~2&*** Finis  ***~2%"
   !eval! (signal-done 1)
   !eval! (display-dwell-times)
   !stop!
)

;;; Place end-task at the end so it has a lower priority than finis
;;; Actually, since utility of end-task will be learned, we need to
;;; set a high prior for finis, or rely on the default

(p end-task
   =goal>
      isa         control
      task        =task  ;; not nil
==>
  =goal>
      last-task   =task
      task        nil
)

;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;;update top goal (for subgoals) -- passes value from subgoal back to
control chunk and makes it the goal
```

```
;;;  also update speed, waypoint, and waypoint depending on whether
it's a speed, waypoint, or distance decision
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;

(p update-top-goal-communication
   =goal>
      isa communication
   =retrieval>
      isa         control
==>
   +goal>
      =retrieval
)

(p update-top-goal-set-flap
   =goal>
      isa         set-flap
      flap        =flap
      speed       =speed  ;;speed decision
   =retrieval>
      isa         control
==>
   =retrieval>
      flaps       =flap
      speed       =speed
   +goal>
      =retrieval
   !eval! (setf *PFD-dwell* (+ *PFD-dwell* (- (actr-time) *mark*)))
)

(p update-top-goal-check-altitude
   =goal>
      isa         check-altitude
      altitude    =altitude
      - altitude looking
   =retrieval>
      isa         control
==>
   =retrieval>
      altitude    =altitude
   +goal>
      =retrieval
   !eval! (setf *PFD-dwell* (+ *PFD-dwell* (- (actr-time) *mark*)))
)

(p update-top-goal-set-altitude
   =goal>
      isa         dial-altitude
      altitude    =altitude
      waypoint    =waypoint  ;;waypoint decision
   =retrieval>
      isa         control
==>
   =retrieval>
      waypoint    =waypoint
   +goal>
```

```
      =retrieval
   !eval! (setf *NAV-dwell* (+ *NAV-dwell* (- (actr-time) *mark*)))
)

(p update-top-goal-set-speed
   =goal>
      isa         set-speed
      speed       =speed
      distance    =distance  ;;distance decision
   =retrieval>
      isa         control
==>
   =retrieval>
      speed       =speed
      distance    =distance
   +goal>
      =retrieval
   !eval! (setf *NAV-dwell* (+ *NAV-dwell* (- (actr-time) *mark*)))
)

(p update-top-goal-move-gear
   =goal>
      isa         move-gear
      decision    =decision
      distance    =distance  ;;distance decision
   =retrieval>
      isa         control
==>
   =retrieval>
      landing-gear =decision
      distance    =distance
   +goal>
      =retrieval
   !eval! (setf *NAV-dwell* (+ *NAV-dwell* (- (actr-time) *mark*)))
)

(p update-top-goal-speed-brakes
   =goal>
      isa         speed-brakes
      decision    =decision
      speed       =speed  ;;speed decision
   =retrieval>
      isa         control
==>
   =retrieval>
      airbrakes   =decision
      speed       =speed
   +goal>
      =retrieval
   !eval! (setf *PFD-dwell* (+ *PFD-dwell* (- (actr-time) *mark*)))
)

(p update-top-goal-set-decision-alt
   =goal>
      isa         set-decision-altitude
      decision    =decision
      distance    =distance  ;;distance decision
```

```
   =retrieval>
      isa         control
==>
   =retrieval>
      decision-altitude =decision
      distance    =distance
   +goal>
      =retrieval
   !eval! (setf *NAV-dwell* (+ *NAV-dwell* (- (actr-time) *mark*)))
)

(p update-top-goal-set-autopilot
   =goal>
      isa         set-autopilot
      decision    =decision
   =retrieval>
      isa         control
==>
   =retrieval>
      autopilots  =decision
   +goal>
      =retrieval
   !eval! (setf *MCP-dwell* (+ *MCP-dwell* (- (actr-time) *mark*)))
)


;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;; Approach - a scripted set of actions to put the aircraft in
configuration for approach
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
(p approach-checklist-lnav
   =goal>
      isa         approach
      lnav        nil
   !eval! (null *retrieval-scheduler*)
 ==>
   =goal>
      lnav        set
   +look>
      isa         look
      where       Distance-next
;;   +action>  ;; not simulated yet
;;      isa             action
;;      what            lnav
;;      do        do
;;      setting   engaged
   !output! "PROCEDURAL ~8,3F Preparing for approach: setting LNAV~%"
(actr-time)
   !eval! (setf *PFD-dwell* (+ *PFD-dwell* (- (actr-time) *mark*)))
   !eval! (setf *mark* (actr-time))
)

(p approach-checklist-vnav
   =goal>
      isa         approach
```

```
      vnav        nil
   !eval! (null *retrieval-scheduler*)
 ==>
   +look>
      isa         look
      where       waypoint
   =goal>
      vnav        set
;;   +action>  ;; not simulated yet
;;      isa             action
;;      what            vnav
;;      do        set
;;      setting   engaged
   !output! "PROCEDURAL ~8,3F Preparing for approach: setting VNAV~%"
(actr-time)
   !eval! (setf *PFD-dwell* (+ *PFD-dwell* (- (actr-time) *mark*)))
   !eval! (setf *mark* (actr-time))
)

(p approach-checklist-autopilot
   =goal>
      isa         approach
      autopilot   nil
   !eval! (null *retrieval-scheduler*)
 ==>
   +look>
      isa         look
      where       autopilots
   =goal>
      autopilot   set
;;   +action>  ;;they're already set and it's a toggle, so don't un-set
;;      isa             action
;;      what            autopilot
;;      do        set
;;      setting   engaged
   !output! "PROCEDURAL ~8,3F Preparing for approach: engaging
Autopilot~%" (actr-time)
   !eval! (setf *NAV-dwell* (+ *NAV-dwell* (- (actr-time) *mark*)))
   !eval! (setf *mark* (actr-time))
)

(p approach-checklist-flaps
   =goal>
      isa         approach
      flaps       nil
   !eval! (null *retrieval-scheduler*)
 ==>
   =goal>
      flaps       set
   +action>
      isa         action
      setting     1
      what        flaps
      do          set
   !output! "PROCEDURAL ~8,3F Preparing for approach: setting Flaps
1~%" (actr-time)
```

```
   !eval! (setf *CONTROLS-dwell* (+ *CONTROLS-dwell* (- (actr-time)
*mark*)))
   !eval! (setf *mark* (actr-time))
)

(p approach-checklist-speedbrakes
   =goal>
      isa               approach
      speed-brakes      nil
   !eval! (null *retrieval-scheduler*)
 ==>
   +look>
      isa          look
      where        airbrakes
   =goal>
      speed-brakes      set
   +action>
      isa          action
      what         airbrakes
      do on/off
   !output! "PROCEDURAL ~8,3F Preparing for approach: engaging Speed-
brakes full~%" (actr-time)
   !eval! (setf *CONTROLS-dwell* (+ *CONTROLS-dwell* (- (actr-time)
*mark*)))
   !eval! (setf *mark* (actr-time))
)

(p approach-checklist-complete
   =goal>
      isa          approach
      - autopilot        nil
      - speed-brakes     nil
      - lnav             nil
      - vnav             nil
      - flaps            nil
      status             nil
   !eval! (null *retrieval-scheduler*)
 ==>
   =goal>
     status checklist-complete
   -look>
   +retrieval>
      isa          control
)

(p return-from-approach-checklist
   =goal>
     isa    approach
     status checklist-complete
   =retrieval>
     isa    control
 ==>
   -goal>
   +goal>
     =retrieval
)
```

```
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;; Landing-checklist - a scripted set of actions to prepare for
landing on final approach
;;;   have to maintain separate dwell times for each of these...
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;

(p landing-checklist-flaps
   =goal>
      isa         landing-checklist
      flaps       nil
   !eval! (null *retrieval-scheduler*)
 ==>
   =goal>
      flaps       set
   +action>
      isa         action
      setting     15
      what        flaps
      do          set
   !output! "PROCEDURAL ~8,3F Landing checklist: setting Flaps 15~%"
(actr-time)
   !eval! (setf *CONTROLS-dwell* (+ *CONTROLS-dwell* (- (actr-time)
*mark*)))
   !eval! (setf *mark* (actr-time))
)

(p landing-checklist-speedbrakes
   =goal>
      isa                landing-checklist
      speed-brakes       nil
   !eval! (null *retrieval-scheduler*)
 ==>
   +look>
      isa         look
      where       airbrakes
   =goal>
      speed-brakes       set
   +action>
      isa         action
      what        airbrakes
      do on/off
   !output! "PROCEDURAL ~8,3F Landing checklist: setting Speed-brakes
to armed~%" (actr-time)
   !eval! (setf *CONTROLS-dwell* (+ *CONTROLS-dwell* (- (actr-time)
*mark*)))
   !eval! (setf *mark* (actr-time))
)

(p landing-checklist-speed
   =goal>
      isa         landing-checklist
      speed       nil
   !eval! (null *retrieval-scheduler*)
 ==>
```

```
   =goal>
      speed       set
   +action>
      isa         action
      setting     135
      what        speed
      do          set
   !output! "PROCEDURAL ~8,3F Landing checklist: setting Speed to
135~%" (actr-time)
   !eval! (setf *CONTROLS-dwell* (+ *CONTROLS-dwell* (- (actr-time)
*mark*)))
   !eval! (setf *mark* (actr-time))
)

(p landing-checklist-gear
   =goal>
      isa         landing-checklist
      gear  nil
   !eval! (null *retrieval-scheduler*)
 ==>
   =goal>
      gear        set
   +action>
      isa         action
      what        landing-gear
      do up/down               ;Toggle
   !output! "PROCEDURAL ~8,3F Landing checklist: setting Gear down 1~%"
(actr-time)
   !eval! (setf *CONTROLS-dwell* (+ *CONTROLS-dwell* (- (actr-time)
*mark*)))
   !eval! (setf *mark* (actr-time))
)

(p landing-checklist-cabin
   =goal>
      isa         landing-checklist
      cabin       nil
   !eval! (null *retrieval-scheduler*)
 ==>
   =goal>
      cabin       set
   +action>
      isa         action
      what        nothing
      do          Communication
      setting     2007
   !output! "PROCEDURAL ~8,3F Landing checklist: preparing cabin for
landing~%" (actr-time)
   !eval! (setf *mark* (actr-time))  ;; this goes into "off" time
)

(p landing-checklist-complete
   =goal>
      isa         landing-checklist
      - speed-brakes    nil
      - flaps           nil
      - speed           nil
```

```
      - gear            nil
      - cabin           nil
      status            nil
   !eval! (null *retrieval-scheduler*)
 ==>
   =goal>
     status checklist-complete
   -look>
   +retrieval>
      isa         control
   !output! "VOCAL ~8,3F Landing Checklist Complete~%" (actr-time)
)

(p return-from-landing-checklist
   =goal>
     isa    landing-checklist
     status checklist-complete
   =retrieval>
     isa    control
 ==>
   =retrieval>
     landing-checklist checked
   +goal>
     =retrieval
)


;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;; Communications
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;

(p chatter
   =goal>
      isa         communication
      chatter     =type
   !eval! (null *retrieval-scheduler*)
   ==>
   !bind! =reply (chatter =type)          ;Takes time
   +action>
      isa         action
      what        nothing
      do          Communication
      setting     =reply
   +retrieval>
      isa         control
)


;; atc message interrupts current goal
(p atc-message
   =look>
     isa look
     where atc
   ==>
   +goal>
```

```
     =look
   -look>
   -retrieval>
)


(p clear-atc-message
   =goal>
     isa look
     where atc
     setting =type
     - setting clear-atc
     - setting 2001
   ==>
   -look>
   =goal>
     setting clear-atc
   !bind! =reply (chatter =type)
   +action>
      isa          action
      what         ATC
      do           Communication
      setting      =reply
   +retrieval>
      isa          control
    !output! "AURAL ~8,3F ATC message ~S~%" (actr-time) =type
)


(p late-reassignment
   =goal>
     isa look
     where atc
     setting 2001
     setting =type
   ==>
   -look>
   =goal>
     setting clear-atc
   !bind! =reply (chatter =type)
   +action>
      isa          action
      what         ATC
      do           Communication
      setting      =reply
   +retrieval>
      isa          control
   !output! "AURAL ~8,3F ATC message ~S~%" (actr-time) =type
   !output! "PROCEDURAL ~8,3F Late Reassignment (Switch to parallel
runway)" (actr-time)
   ;;!eval! (signal-done 3)
)


(p reestablish-goal-after-atc-message
   =goal>
     isa look
```

```
     where atc
     setting clear-atc
   =retrieval>
     isa control
   ==>
   +goal>
     =retrieval
)

;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;; Productions for reading decision values (for the three super-types
for controls: speed, waypoint, distance)
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;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;

;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;; Speed-decision
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;

(p get-speed-svs
   =goal>
      isa         speed-decision
      speed       nil
   !eval! (not (null *svs-present*))
 ==>
    +look>
      isa         look
      where       speed
      source      svs
    =goal>
      speed       looking
   !eval! (setf *SVS-dwell* (+ *SVS-dwell* (- (actr-time) *mark*)))  ;;
this was the time to look at speed
)


;; the IMPRINT model passes speed as the speed dial -- it should come
from the PFD!!!  Changed dwell time to give PFD credit.
(p get-speed-dial
   =goal>
      isa         speed-decision
      speed       nil
 ==>
    +look>
      isa         look
      where       speed
      source      dial
    =goal>
      speed       looking
   !eval! (setf *PFD-dwell* (+ *PFD-dwell* (- (actr-time) *mark*)))  ;;
this was the time to look at speed
)

(p read-speed
```

```
   =goal>
     isa           speed-decision
     speed         looking
   =look>
     isa           look
     where  speed
     setting       =speed
==>
   -look>
   =goal>
      speed        =speed
   !eval! (setf *mark* (actr-time))                                  ;;
start a new clock for the rest of the supergoal
)

;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;; Waypoint-decision
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;

(p get-waypoint-svs
   =goal>
     isa           waypoint-decision
     waypoint      nil
   !eval! (not (null *svs-present*))
 ==>
   +look>
      isa          look
      where        waypoint
      source       svs
   =goal>
      waypoint     looking
   !eval! (setf *SVS-dwell* (+ *SVS-dwell* (- (actr-time) *mark*)))  ;;
this was the time to look at speed
)

(p get-waypoint-dial
   =goal>
     isa           waypoint-decision
     waypoint      nil
 ==>
   +look>
      isa          look
      where        waypoint
      source       dial
   =goal>
      waypoint     looking
   !eval! (setf *NAV-dwell* (+ *NAV-dwell* (- (actr-time) *mark*)))  ;;
this was the time to look at waypoint
)

(p read-waypoint
   =goal>
      isa          waypoint-decision
      waypoint     looking
   =look>
```

```
      isa         look
      where       waypoint
      setting     =waypoint
==>
   -look>
     =goal>
      waypoint    =waypoint
   !eval! (setf *mark* (actr-time))                                    ;;
start a new clock for the rest of the supergoal
)

;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;; Distance-decision
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;

(p get-distance-next-svs
   =goal>
      isa         distance-decision
      - waypoint  looking
      waypoint    =got
      distance-next nil
   !eval! (not (null *svs-present*))
==>
   +look>
      isa         look
      where       distance-next
      source      svs
   =goal>
      distance-next looking
   !eval! (setf *SVS-dwell* (+ *SVS-dwell* (- (actr-time) *mark*)))  ;;
this was the time to look at speed
)

(p get-distance-next-dial
   =goal>
      isa         distance-decision
      - waypoint  looking
      waypoint    =got
      distance-next nil
==>
   +look>
      isa         look
      where       distance-next
      source      dial
   =goal>
      distance-next looking
   !eval! (setf *NAV-dwell* (+ *NAV-dwell* (- (actr-time) *mark*)))  ;;
this was the time to look at distance
)

(p read-distance
   =goal>
      isa         distance-decision
      distance-next looking
   =look>
```

```
      isa         look
      where       distance-next
      setting     =distance
==>
   -look>
   =goal>
      distance-next =distance)


(p compute-distance
   =goal>
      isa         distance-decision
      waypoint    =which
      - distance-next looking
      distance-next =next
      distance    nil
   =waypoint>
      isa         waypoint
      id          =which
      range       =range
==>
   !bind! =distance (+ =next =range)
   !output! "RETRIEVAL ~8,3F Waypoint ~d Next ~d Distance ~d~%"
   (actr-time) =which =next =distance
   -look>
   =goal>
      distance    =distance
   !eval! (setf *mark* (actr-time))                                    ;;
start a new clock for the rest of the supergoal
)

;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;; Remove the ignore productions and
;;; the !eval! for redundent decisions

;;; Separate productions for each instance-based decision
;;; When the goal is set up (presumably externally),
;;; perform a retrieval, call the action function if necessary,
;;; update the goal then pop it to enrich the instance base.

;;; one (or two) of these reading productions for each subgoal

;;; Note that the retrieval must check that flaps are not nil
;;; otherwise the current can and usually will be retrieved
;;; leading to an infinite loop

;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;; Set-flap
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;

(p retrieve-flap
   =goal>
      isa         set-flap
      - speed     looking
```

```
      speed       =speed  ;;get speed decision first
      flap        nil
;;;      flap     =current
   !eval! (null *retrieval-scheduler*)
 ==>
   +retrieval>
      isa         set-flap
      speed       =speed
      - flap      nil
   ;; change the goal after initiating the retrieval so it can't be
retrieved (it's still nil) -- the implementation is sequential!
;;   =goal>
;;    flap        get-flap
)

(p compute-flap
   =goal>
      isa         set-flap
      - speed     looking
      speed       =speed
;;    flap        get-flap
      flap        nil
;;;      flap     =current
   =retrieval>
      isa         set-flap
;;    speed       =speed
      flap        =flap
      - flap      get-flap
;;;   !eval! (not (equalp =current =flap))
 ==>
    =goal>
      flap        =flap
    !output! "RETRIEVAL ~8,3F Flaps ~S~%" (actr-time) =flap
    +look>
       isa        look
       where      flaps
)


(p set-flaps
   =goal>
      isa         set-flap
      flap        =flap
   =look>
      isa         look
      where       flaps
      - setting   =flap
      setting     =old
   !eval! (null *retrieval-scheduler*)
==>
   -look>
   +action>
      isa         action
      setting     =flap
      what        flaps
      do          set
   +retrieval>
```

```
      isa         control
)

(p flaps-already-set
   =goal>
      isa         set-flap
      flap        =flap
   =look>
      isa         look
      where       flaps
      setting     =flap
   !eval! (null *retrieval-scheduler*)
==>
   -look>
   !output! "PROCEDURAL ~8,3F Confirm Flaps already set to ~S~%" (actr-
time) =flap
   +retrieval>
      isa         control
)

(p ignore-flap
   =goal>
      isa         set-flap
      - speed     nil
      - speed     looking
      flap        nil
   !eval! (null *retrieval-scheduler*)
==>
   +retrieval>
      isa         control
)

;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;; Check-Altitude
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;

(p check-altitude
   =goal>
      isa         check-altitude
      altitude    nil
   !eval! (null *retrieval-scheduler*)
==>
   +look>
     isa          look
     where        altitude
   =goal>
     altitude     looking
)

(p read-altitude
   =goal>
      isa         check-altitude
      altitude    looking
      previous    =previous
   =look>
```

```
      isa         look
      where       altitude
      setting     =altitude
   !eval! (null *retrieval-scheduler*)
   !eval! (> (abs (- =previous =altitude)) 150)
==>
   =goal>
     altitude     =altitude
   -look>
   +retrieval>
      isa         control
)

;; still update the altitude -- penalize if the change isn't big or the
model only looks at altitude
(p ignore-altitude
   =goal>
      isa         check-altitude
      altitude    looking
      previous    =previous
   =look>
      isa         look
      where       altitude
      setting     =altitude
==>
   =goal>
      altitude    =altitude
   -look>
   +retrieval>
      isa         control
)

;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;; Dial-Altitude
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;

(p get-dial-altitude
   =goal>
      isa         dial-altitude
      - waypoint  looking
      waypoint    =which  ;;get waypoint decision first
      altitude    nil
   !eval! (null *retrieval-scheduler*)
==>
   +retrieval>
      isa         dial-altitude
      waypoint    =which
      - altitude  nil
)

(p figure-dial-altitude
   =goal>
      isa         dial-altitude
      - waypoint  looking
      waypoint    =which
```

```
      altitude    nil
   =retrieval>
      isa         dial-altitude
      altitude    =altitude
==>
   =goal>
     altitude     =altitude
   !output! "RETRIEVAL ~8,3F Altitude ~S~%" (actr-time) =altitude
   +look>
      isa         look
      where       dial-altitude)

(p dial-altitude
   =goal>
      isa         dial-altitude
      altitude    =altitude
   =look>
      isa         look
      where       dial-altitude
      - setting   =altitude
      setting     =old
   !eval! (null *retrieval-scheduler*)
==>
   +action>
      isa         action
      what        dial-altitude
      do          set
      setting     =altitude
   -look>
   +retrieval>
      isa         control
)

(p dial-altitude-already-dialed
   =goal>
      isa         dial-altitude
      altitude    =altitude
   =look>
      isa         look
      where       dial-altitude
      setting     =altitude
   !eval! (null *retrieval-scheduler*)
==>
   -look>
   !output! "PROCEDURAL ~8,3F Confirm Altitude already set to ~S~%"
(actr-time) =altitude
   +retrieval>
      isa         control
)

(p ignore-dial-altitude
   =goal>
      isa         dial-altitude
      - waypoint  nil
      - waypoint  looking
      altitude    nil
   !eval! (null *retrieval-scheduler*)
```

```
==>
   -look>
   +retrieval>
      isa         control
)

;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;; Set-Speed
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
(p retrieve-speed
   =goal>
      isa         set-speed
      - distance  looking
      distance    =distance  ;;get distance decision first
      speed       nil
   !eval! (null *retrieval-scheduler*)
==>
   +retrieval>
      isa         set-speed
      distance    =distance
    - speed nil
)

(p figure-speed
   =goal>
      isa         set-speed
      - distance  looking
      speed       nil
   =retrieval>
      isa         set-speed
      distance    =distance
      speed       =speed
==>
   =goal>
      speed       =speed
   !output! "RETRIEVAL ~8,3F Speed ~%" (actr-time) =speed
   +look>
      isa         look
      where       dial-speed
)

(p dial-speed
   =goal>
      isa         set-speed
      speed       =speed
   =look>
      isa         look
      where       dial-speed
      - setting   =speed
      setting     =old
   !eval! (null *retrieval-scheduler*)
   ==>
   +action>
      isa         action
      what        dial-speed
```

```
      do           set
      setting      =speed
   -look>
   +retrieval>
      isa          control
)

(p speed-already-dialed
   =goal>
      isa          set-speed
      speed        =speed
   =look>
      isa          look
      where        dial-speed
      setting      =speed
   !eval! (null *retrieval-scheduler*)
   ==>
   -look>
   !output! "PROCEDURAL ~8,3F Confirm Speed already set to ~S~%" (actr-
time) =speed
   +retrieval>
      isa          control
)

(p ignore-speed
   =goal>
      isa          set-speed
      - distance   nil
      - distance   looking
      speed        nil
   !eval! (null *retrieval-scheduler*)
==>
   +retrieval>
      isa          control
)

;;; What to do for rule-based productions?
;;; Currently, only rules for one-time decisions

;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;; Move-Gear
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;

#|
(p abort-landing
   =goal>
   isa             move-gear
   - distance      looking
   distance        =distance  ;;get distance decision first
   !eval! (zerop =distance)
   !eval! (null *retrieval-scheduler*)
 ==>
   !output! "PROCEDURAL ~8,3F Over Runway (Abort Landing)" (actr-time)
   !eval! (signal-done 3)
   !stop!
```

```
   +retrieval>
      isa         control
)
|#


(p decide-gear
   =goal>
      isa         move-gear
      - distance  looking
      distance    =distance
      decision    nil
   !bind! =decision (if (<= =distance 15.0) 'down 'up)
==>
   +look>
      isa         look
      where       landing-gear
    =goal>
      decision    =decision)

(p move-gear
   =goal>
      isa         move-gear
      decision    =decision
   =look>
      isa         look
      where       landing-gear
      - setting   =decision
      setting     =old
   !eval! (null *retrieval-scheduler*)
==>
   -look>
   !output! "PROCEDURAL ~8,3F Lowering Gear" (actr-time)
   +action>
      isa         action
      what        landing-gear
      do up/down               ;Toggle
   =goal>
      decision    =decision
   +retrieval>
      isa         control
)

(p gear-already-moved
   =goal>
      isa         move-gear
      decision    =decision
   =look>
      isa         look
      where       landing-gear
      setting     =decision
   !eval! (null *retrieval-scheduler*)
==>
   -look>
   !output! "PROCEDURAL ~8,3F Confirm Gear already set to ~S~%" (actr-
time) =decision
   =goal>
```

```
      decision    =decision
   +retrieval>
      isa         control
)

(p ignore-gear
   =goal>
      isa         move-gear
      - distance  nil
      - distance  looking
   !eval! (null *retrieval-scheduler*)
==>
   +retrieval>
      isa         control
)

;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;; speed-brakes
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;

(p decide-speed-brakes
   =goal>
      isa         speed-brakes
      - speed     looking
      speed       =speed  ;;get speed decision first
      decision    nil
   !bind! =decision (if (<= =speed 145.0) 'on 'off)
==>
   +look>
      isa         look
      where       airbrakes
   =goal>
      decision    =decision)

(p set-speed-brakes
   =goal>
      isa         speed-brakes
      decision    =decision
   =look>
      isa         look
      where       airbrakes
   - setting      =decision
   setting        =old
   !eval! (null *retrieval-scheduler*)
==>
   -look>
   !output! "PROCEDURAL ~8,3F Setting Speed Brakes" (actr-time)
   +action>
      isa         action
      what        airbrakes
      do on/off                    ;Toggle?
   +retrieval>
      isa         control
)
```

```
(p speed-brakes-already-set
   =goal>
      isa         speed-brakes
      decision    =decision
   =look>
      isa         look
      where       airbrakes
      setting     =decision
   !eval! (null *retrieval-scheduler*)
==>
   -look>
   !output! "PROCEDURAL ~8,3F Confirm Speed Brakes already set to ~S~%"
(actr-time) =decision
   +retrieval>
      isa         control
)

(p ignore-speed-brakes
   =goal>
      isa         speed-brakes
      - speed     nil
      - speed     looking
      decision    =decision
   !eval! (null *retrieval-scheduler*)
==>
   +retrieval>
      isa         control
)

;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;; Set decision altitude
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;

(p figure-decision-altitude
   =goal>
      isa         set-decision-altitude
      - distance  looking
      distance    =distance  ;;get distance decision first
      old         =current
   !eval! (and (< =distance 12) (/= =current 600.0))
   !eval! (null *retrieval-scheduler*)
==>
   !output! "PROCEDURAL ~8,3F Setting Decision Altitude to 600 feet"
   (actr-time)
   ;; Chancy
   +action>
      isa         action
      what        decision-altitude
      do          set
      value       600.0
   =goal>
     decision     600.0
   +retrieval>
      isa         control
)
```

```
(p ignore-decision-altitude
   =goal>
      isa          set-decision-altitude
      - distance   nil
      - distance   looking
      old          =current
   !eval! (null *retrieval-scheduler*)
==>
   =goal>
      decision     =current
   +retrieval>
      isa          control
)

;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;; Set autopilot
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;

(p get-visibility
   =goal>
      isa          set-autopilot
      visibility   nil
==>
   +look>
      isa          look
;;      where      otw_ground
      where        otw_runway
   =goal>
      visibility looking)

(p read-visibility
   =goal>
      isa          set-autopilot
      visibility   looking
   =look>
      isa          look
;;      where      otw_ground
      where        otw_runway
      setting      =visibility
==>
   +look>
      isa          look
      where        autopilots
    =goal>
       visibility =visibility
   !eval! (setf *OTW-dwell* (+ *CONTROLS-dwell* (- (actr-time)
*mark*)))  ;;look out window for visibility
   !eval! (setf *mark* (actr-time))
)

;; disengaging autopilot concludes vectored approach, and late
reassignment
(p disengage-autopilot
```

```
   =goal>
      isa         set-autopilot
      visibility  in-sight
   =look>
      isa         look
      where       autopilots
      setting     up
   !eval! (null *retrieval-scheduler*)
==>
   !eval! (incf *landings*)
   -look>
   !output! "PROCEDURAL ~8,3F Disengage Autopilot and land" (actr-time)
   +action>                   ;Toggle
      isa         action
      what        autopilots
      do          up/down
    =goal>
      decision    disengaged
   +retrieval>
      isa         control
)

;; disengaging autopilot for traffic on runway
(p disengage-autopilot-runway-traffic
   =goal>
      isa         set-autopilot
      visibility  runway-traffic
   =look>
      isa         look
      where       autopilots
      setting     up
   !eval! (null *retrieval-scheduler*)
==>
   !eval! (incf *landings*)
   -look>
   !output! "PROCEDURAL ~8,3F Traffic on runway -- going around" (actr-
time)
   +action>                   ;Toggle
      isa         action
      what        autopilots
      do          up/down
    =goal>
      decision    disengaged
   +retrieval>
      isa         control
)

;; disengaging autopilot for runway misaligned
(p disengage-autopilot-runway-misaligned
   =goal>
      isa         set-autopilot
      visibility  runway-off-alignment
   =look>
      isa         look
      where       autopilots
      setting     up
   !eval! (null *retrieval-scheduler*)
```

```
==>
   !eval! (incf *landings*)
   -look>
   !output! "PROCEDURAL ~8,3F Runway misaligned -- going around" (actr-
time)
   +action>                    ;Toggle
      isa          action
      what         autopilots
      do           up/down
    =goal>
      decision     disengaged
   +retrieval>
      isa          control
)

(p peek
   =goal>
     isa           set-autopilot
     visibility    =v
     - visibility looking
     - visibility       in-sight
     peek          nil
   ==>
   +look>
     isa           look
     where         altitude
   =goal>
     peek          looking)

(p read-peek
   =goal>
     isa           set-autopilot
     visibility    =v
     peek          looking
   =look>
     isa           look
     where         altitude
     setting       =alt
==>
   =goal>
     peek          =alt)


(p ignore-autopilot
   =goal>
      isa          set-autopilot
      visibility   out-of-sight
      peek         =p
      decision nil
   !eval! (null *retrieval-scheduler*)
==>
   -look>
   =goal>
      decision     engaged
   +retrieval>
      isa          control
)
```

```
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
(setq *quitting-time* 600.0)

;;; Penalize the ignore productions

(spp (ignore-flap ignore-dial-altitude ignore-speed ignore-gear
      ignore-speed-brakes ignore-decision-altitude ignore-autopilot
      speed-brakes-already-set gear-already-moved speed-already-dialed
      dial-altitude-already-dialed flaps-already-set ignore-altitude)
     :successes 1 :failures 100 :efforts 10000)

;;; Learning parameters
(spp (UPDATE-TOP-GOAL-COMMUNICATION UPDATE-TOP-GOAL-SET-FLAP
      UPDATE-TOP-GOAL-SET-ALTITUDE UPDATE-TOP-GOAL-SET-SPEED
      UPDATE-TOP-GOAL-MOVE-GEAR UPDATE-TOP-GOAL-SPEED-BRAKES
      UPDATE-TOP-GOAL-SET-DECISION-ALT UPDATE-TOP-GOAL-SET-AUTOPILOT
      UPDATE-TOP-GOAL-CHECK-ALTITUDE)
     :effort (task-effort) :efforts 1.0 ;;; do not bias the initial
utility
     :success t
     )

(spp end-task
     :successes 10 :failures 20
     :success (select-task-success) :failure (select-task-failure))
```

Appendix D – Subject Dwell Times

Subject 3 Dwell Time in Area of Interest as Percentage of Total Time

Scenario	MCP	NAV	PFD	SVS	CONTROLS	OTW	off	Total-time
1	0.05	0.32	0.42	0.00	0.09	0.08	0.02	1.00
2	0.08	0.32	0.40	0.00	0.13	0.04	0.02	1.00
3	0.05	0.29	0.46	0.00	0.09	0.07	0.02	1.00
4	0.09	0.31	0.45	0.00	0.11	0.00	0.02	1.00
5	0.08	0.30	0.48	0.00	0.12	0.01	0.02	1.00
6	0.05	0.45	0.13	0.00	0.08	0.04	0.26	1.00
7	0.06	0.26	0.32	0.23	0.11	0.00	0.02	1.00
8	0.05	0.21	0.27	0.37	0.07	0.01	0.02	1.00
9	0.04	0.29	0.40	0.14	0.09	0.01	0.02	1.00
10	0.03	0.27	0.37	0.20	0.08	0.02	0.03	1.00
Avg	0.06	0.30	0.37	0.09	0.10	0.03	0.04	1.00

Subject 4 Dwell Time in Area of Interest as Percentage of Total Time

Scenario	MCP	NAV	PFD	SVS	CONTROLS	OTW	off	Total-time
1	0.01	0.45	0.40	0.00	0.00	0.11	0.01	1.00
2	0.00	0.34	0.49	0.00	0.02	0.08	0.05	1.00
3	0.01	0.40	0.43	0.00	0.02	0.09	0.03	1.00
4	0.01	0.30	0.50	0.01	0.04	0.08	0.05	1.00
5	0.01	0.41	0.49	0.00	0.02	0.04	0.02	1.00
6	0.02	0.35	0.42	0.08	0.02	0.07	0.04	1.00
7	0.06	0.30	0.30	0.17	0.02	0.07	0.06	1.00
8	0.04	0.31	0.37	0.13	0.05	0.05	0.04	1.00
9	0.01	0.30	0.32	0.30	0.01	0.03	0.03	1.00
10	0.00	0.30	0.46	0.10	0.02	0.05	0.05	1.00
Avg	0.02	0.35	0.42	0.08	0.02	0.07	0.04	1.00

Subject 5 Dwell Time in Area of Interest as Percentage of Total Time

Scenario	MCP	NAV	PFD	SVS	CONTROLS	OTW	off	Total-time
1	0.04	0.36	0.40	0.00	0.02	0.09	0.05	1.00
2	0.02	0.49	0.28	0.00	0.05	0.09	0.04	1.00
3	0.04	0.41	0.30	0.00	0.00	0.10	0.13	1.00
4	0.00	0.49	0.35	0.00	0.05	0.03	0.05	1.00
5	0.03	0.47	0.40	0.00	0.07	0.01	0.01	1.00
6	0.06	0.45	0.40	0.00	0.03	0.02	0.04	1.00
7	0.03	0.30	0.35	0.20	0.05	0.04	0.02	1.00
8	0.03	0.36	0.29	0.23	0.04	0.02	0.02	1.00
9	0.05	0.34	0.31	0.23	0.04	0.00	0.02	1.00
10	0.01	0.28	0.37	0.25	0.02	0.00	0.06	1.00
Avg	0.03	0.40	0.35	0.09	0.04	0.04	0.04	1.00

All Subjects Dwell Time in Area of Interest as Percentage of Total Time

Scenario	MCP	NAV	PFD	SVS	CONTROLS	OTW	off	Total-time
1	0.03	0.38	0.41	0.00	0.04	0.09	0.03	1.00
2	0.03	0.38	0.39	0.00	0.07	0.07	0.03	1.00
3	0.03	0.37	0.40	0.00	0.04	0.08	0.06	1.00
4	0.04	0.37	0.43	0.00	0.07	0.04	0.04	1.00
5	0.04	0.40	0.46	0.00	0.07	0.02	0.02	1.00
6	0.04	0.42	0.32	0.03	0.04	0.04	0.11	1.00
7	0.05	0.29	0.32	0.20	0.06	0.04	0.04	1.00
8	0.04	0.30	0.31	0.25	0.05	0.03	0.03	1.00
9	0.04	0.31	0.35	0.22	0.05	0.01	0.02	1.00
10	0.02	0.28	0.40	0.18	0.04	0.02	0.05	1.00
Avg	0.04	0.35	0.38	0.09	0.05	0.05	0.04	1.00