plans. The SBE gives the user a graphical representation of the area of interest, rather like a modern colour radar display, with the ability to zoom in on any area of interest. The user can then exercise the scenario, with the aircraft flying according to the flight plans in the system. He can build up the scenario from an ATC point of view by adding extra tasks to the scenario as he wishes (such as having the controller put an aircraft on a radar heading, or requesting an aircraft to climb to a new flight level), and this is then logged into the scenario file as he progresses. The full list of ATC tasks that he can create for the controller is a function of the earlier analyses undertaken. The SBE has certain aircraft-related tasks built in (climb, descend, adopt heading, resume own navigation to a beacon, etc.), and can read in the Operational Concept file giving the tasks which do not directly affect the display of aircraft movements, but do nevertheless affect controller workload, and hence must be part of the scenario.

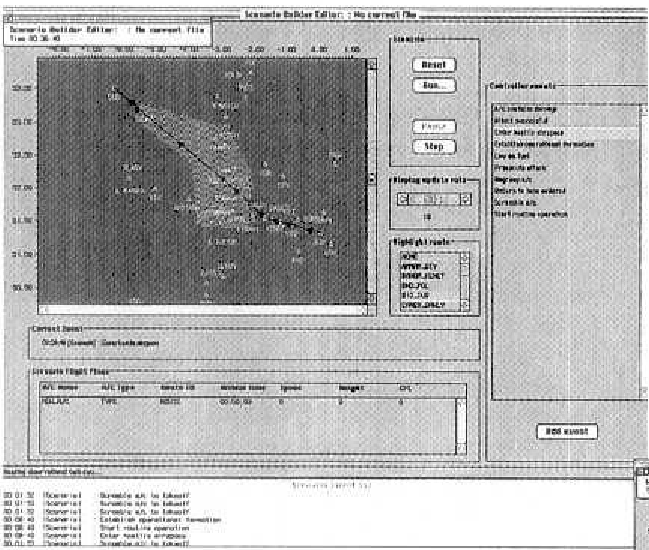

Figure 3 Scenario Builder Editor

The user may continue building (and editing) the scenario until it represents what he wishes, and then he saves the Scenario File for subsequent execution and workload calculation by the toolset. While the SBE provides full support to the user in generating sectors, flight plans, reporting points, and events, it is unlikely that users would want to build these from scratch every time, but would rather prefer to call up existing scenarios from file and modify them as necessary. This modification can be done graphically using the tool, or by directly editing the Scenario File using the Scenario File Editor. Within the file all the parameters are expressed in plain English text, and may be edited accordingly. Thus it was that in the current study use was made of pre-existing definitions of operational scenarios, based on predictions of traffic levels in future time frames, and at particular times of the day.

The next step involved the user reviewing and editing the complete task sequences based on the OTA (the baseline), modified in the light of future operational concepts. Support for this process was provided by the Event Sequence Editor (ESE) tool, which provides a graphical display of aircraft movements (as with the SBE), but as it plays out the aircraft movements it also displays the various controller tasks as timelines. By this means, the team was able to gain the best possible understanding of the scenarios and the controller tasks within it.

Finally, when the complete process of scenario and task editing had been completed, it was possible to invoke the Workload Assessment Tool (WAT) (which is embedded within the ESE), and again play each scenario through, this time also observing the curve of workload against time. The WAT also allowed the team to see the workload data expressed in a histogram form, with the amounts of time spent at each workload level being displayed graphically. (All the PUMA tools which generate graphs can write data out in a format usable by most spreadsheets and charting packages). The WAT has a batch-file mechanism which supports unattended multiple runs with different scenarios and/or operational concepts, each being logged in different ways if necessary. It also provides a comprehensive set of data logging facilities, to allow the data produced during a run to be recorded and analysed further using other packages.

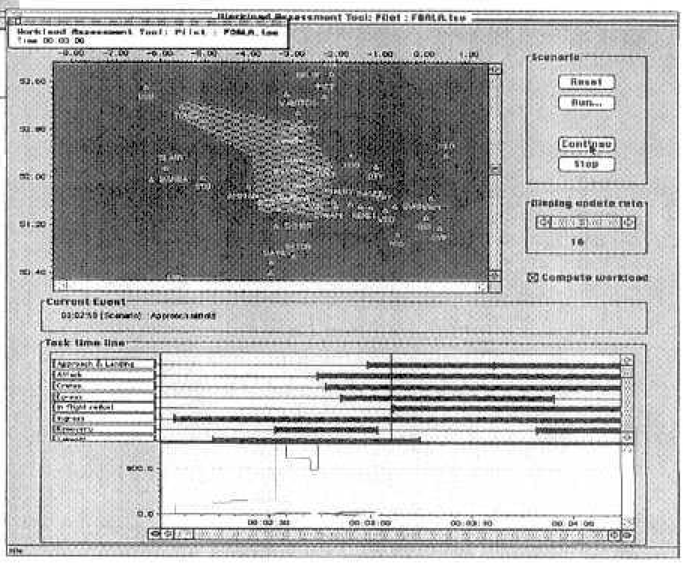

Fig 4 Workload Assessment Tool