SAFETY, INDIVIDUAL PERFORMANCE & MENTAL WORKLOAD IN AIR TRANSPORT:

OEDIPUS AS ICARUS

P. Shipley

Department of Occupational Psychology
Birkbeck College, University of London
Malet Street, London WC1 E7HX
U.K.

ABSTRACT

The increasing practical need to investigate the mental content of jobs to maintain performance quality is illustrated with examples from air transport. The state of knowledge in workload is reviewed in a restatement of the debate about psychology as a natural or social sciences discipline. A synthesis of the two approaches is recommended for mental workload. Studies of the natural sciences kind have produced some interesting findings and should continue. The interdisciplinary attack on this complex subject needs to be broadened, however, to gauge the influence of social factors important for stress and performance at the level of the individual operator. The paper then returns to the issue of generalisation, and asserts the need for more naturalistic studies conducted either in field settings or good simulations of them. Problems of generalisation to and from specially selected and trained groups in transport are also raised.

INTRODUCTION

Much has already been written about the subject of mental load. An exhaustive treatment of such complex literature is outside the scope of this paper and a personal view is given instead. The physical stresses of flying have been well documented elsewhere, (see Ernsting, 1978, for example). There are also useful texts available for lay readers on general 'human factors' aspects of aircraft pilotage. In particular, see Reason (1974). The bias of this paper is more towards the social contributors to performance and safety, which have so far received little attention in the field of air operations.

WORKLOAD: MEANING AND DEMAND

Like 'stress' workload is a fuzzy, ambiguous concept. Attempts to define it exactly have been consistently defeated. Reasons for this include two which fit the argument of this paper. One is that such concepts are borrowed from mechanics, physics and physiology. The other is that human beings are exceedingly complex and we are a long way from understanding ourselves. Yet we continue to think 'there must be something in it'
and if the scholar in us protests at this lack of precision, our human
nenature finds the idea intuitively appealing. We all know what it is like
as private persons, to feel stressed or strained, and we often feel our
workload has something to do with this.

Despite recognition of this definitional problem among scholars for
years, the concepts are now part of our everyday language and requests
continue to be made, for help with practical problems cast in such terms.
Take for example the controversy in the airline industry over the issue of
reducing the flightdeck crew complement from three to two members as a
general norm (see Europilote and US ALPA, 1981). Manufacturers and employ­
ers claim that automation of the modern flightdeck will make a third crew
member redundant. Pilots on the other hand, refute this claim on grounds
of safety. They call for 'workload studies' (op cit, page 2), and state
that: "There is going to be more stress in the cockpits of all future
airliners." (ibid, page 15). Reference is made to heart disease as a
stress disease and "....a real threat of shortened careers due to the
excess stress in a two-pilot cockpit." (ibid, page 16). ...."mental
workload is the real crux of the issue." (ibid, page 36).

The author was a member some years ago of a 'human factors' team pro­
ject based at the University of Loughborough set up to study the contrib­
ution of navigation and communication to flightdeck workload in airliners.
Radio telephony was recorded into a standard domestic tape recorder
directly from the flightdeck's electrical system, and activities of the
crew recorded using a code agreed with operators and a manual (32 switch)
event recorder, carried on the observer's lap. Both streams of data,
radio-telephony and coded events, were analysed and integrated on to a 2
or 3-pilot multiple activity chart.

We found considerable variability in workload type and intensity on
the same routes on different occasions even in relatively similar daytime
conditions. The interrelation between ATC and pilots in their membership
of a larger system meant that flightdeck workload could not be viewed as
if in a vacuum. ATC load led to changes in strategy in that environment
which would affect flightdeck load as a result. The average length of
communications between flightdeck and ATC was about 4\half \ seconds in a sample
of flights on one home sector, and congestion at one terminal area in that
sector on one particular flight led to halving of that average message
length. Instead, content analysis of messages for the flight showed that