Chapter 1

Introduction

Decisionmaking tasks occur when courses of action need to be determined. Investigations of past accidents in industrial and military activities have often concluded or suggested that the performance failure of the human element in decision-making is a primary cause (*e.g.*, Perrow, 1984; Reason, 1990; Pew *et al.*, 1981). However, as pointed out by the contributors in a recent volume on decisionmaking (Klein *et al.*, 1993), researchers (*e.g.*, Hammond, 1986; Sinnott, 1989) as well as practitioners have become dissatisfied with the ways in which human decision-making has been studied. The primary criticism has been that classic approaches to decision-making studies rely almost exclusively on laboratory experiments, using static and simplistic tasks and individual novice subjects. In comparison, in reality people often work in environments

- that are *fast-changing*, *complex* and *uncertain*;
- in which the performance in decision-making carries *high stakes*; and
- in which critical decisions have to be made under *extreme time pressures*.
- in which decisions are made and carried out collectively by multiple individuals in a team.

These characteristics of many work environments call for studies in *naturalistic* settings, in order to understand properties of human decision-making under stress in real life. The ultimate goals of these types of studies are to provide effective decision aids and training programs for those who work in complex, dynamic civil and military environments.

The project reported here was initiated to study decisionmaking under stress in real-environments. A primary objective of it was to ensure simultaneously in one study setting (1) high frequency of occurrence of real-life stressful, life-threatening situations and (2) data-rich recording of events and activities. This objective was important for naturalistic studies because in real environments, high-stress, life-threatening events are often rare and unpredictable; researchers often have inadequacy of documentation and records.

Over the course of the project, we

- Developed a video-audio data acquisition system which was used successfully in the acquisition of multi-media data in a real environment;
- Developed data collection methodologies that collected audio-video recordings, retrospective questionnaires, subjective reviews, performance evaluations and

stress measurements

- Developed a set of video analysis tools to measure communications and task performance
- Developed a software tool that greatly enhances the efficiency of video analysis
- Collected a sizable database which contained multi-media data of performance in a real, stressful environment
- Performed in-depth analysis of a number of cases in terms of the task variables and cognitive processes that influence successful skilled performance and cognitive decision-making in a real situation in which life and death decisions are being made.

In this report, we will identify the major efforts in the study of decision under stress. The chapters are outlined below:

- Chapters 2 and 3 describe existing literature and background information of trauma patient resuscitation.
- Chapters 4 and 5 describe the data collection using video recording in work settings.
- Chapters 6 through 9 describe video analysis methodologies.
- Chapters 10 through 12 describe results of stress measurement and its impact on decisionmaking and team performance.
- Chapter 13 describes several models of decisionmaking.

The majority of the results reported here were from analyses while data collection was on-going. Because of this, the sample sizes used in each analysis were different.