



Predator Decision Making and Human Error: Implications for training 21st Century Warriors

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Dr Bob Nullmeyer

Lt Col Robert Herz

Warfighter Readiness Research Division

Human Effectiveness Directorate



Mishap Analysis Goals



- **Support a Small Business Innovative Research project with Crew Training International (CTI) to improve Crew Resource Management (CRM) training for predator crews**
- **Build on extensive, existing Safety Center data**
- **Understand the nature of Predator Class A mishaps (more than \$1 million damage)**
- **Identify Predator training implications and research needs**



Predator System



- **Four aerial vehicles with sensors**
- **Ground control station**
- **Primary satellite link**
- **Approximately 55 personnel for continuous operations**
- **Operating crew -**
 - **Pilot**
 - **Sensor operator**
 - **Mission planner**

(Source: www.af.mil)





Ground Control Station



(Source: www.af.mil)



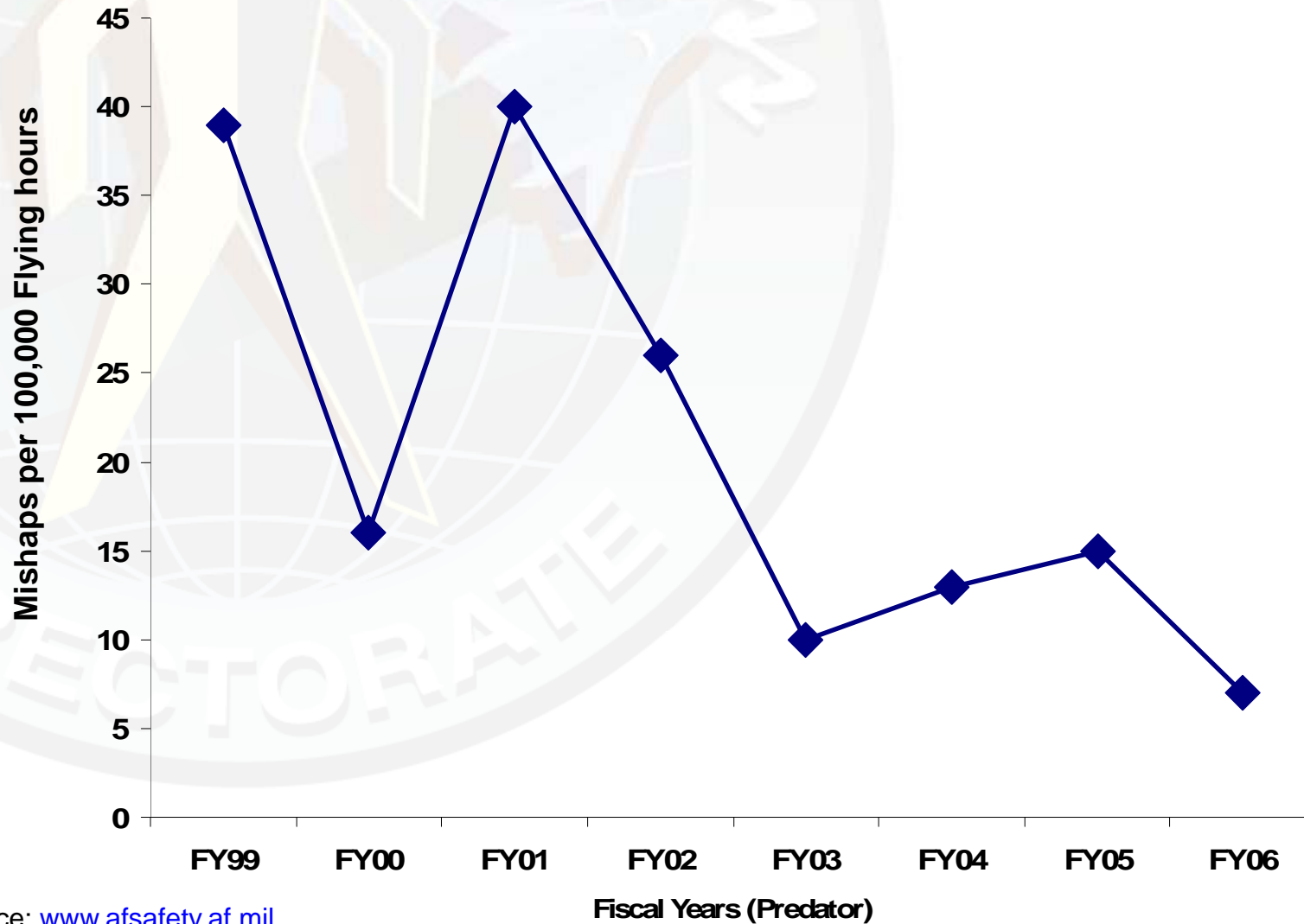
Primary Mishap Data Sources



- **Air Force Safety Center (AFSC) web site (<http://afsafety.af.mil>)**
 - Annual summary flight statistics by aircraft type (hours flown, numbers of mishaps)
- **Accident Investigation Board (AIB) Class A report summaries (<http://usaf.aib.law.af.mil>)**
 - Dates and main causes of Air Force Class A mishaps
- **AFSC data**
 - *Mishap Investigation Board (MIB) report summaries*
 - *Human Factors database*
 - *Relevant discussions from full MIB reports*
 - *Mishap Investigation Board report (Tab T)*
 - *Life Sciences report (Tab Y)*



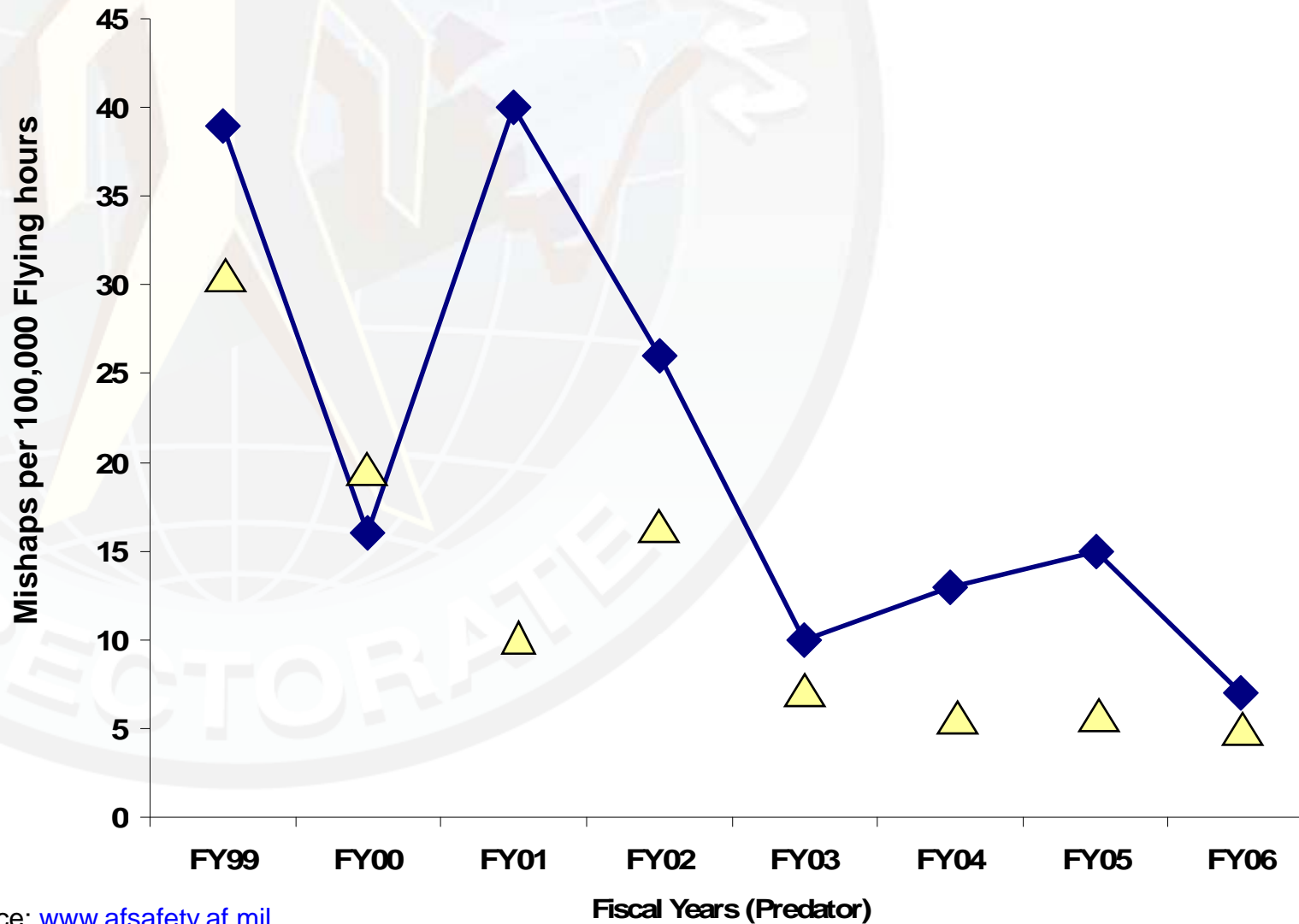
Predator Class A Mishap Rates



Source: www.afsafety.af.mil



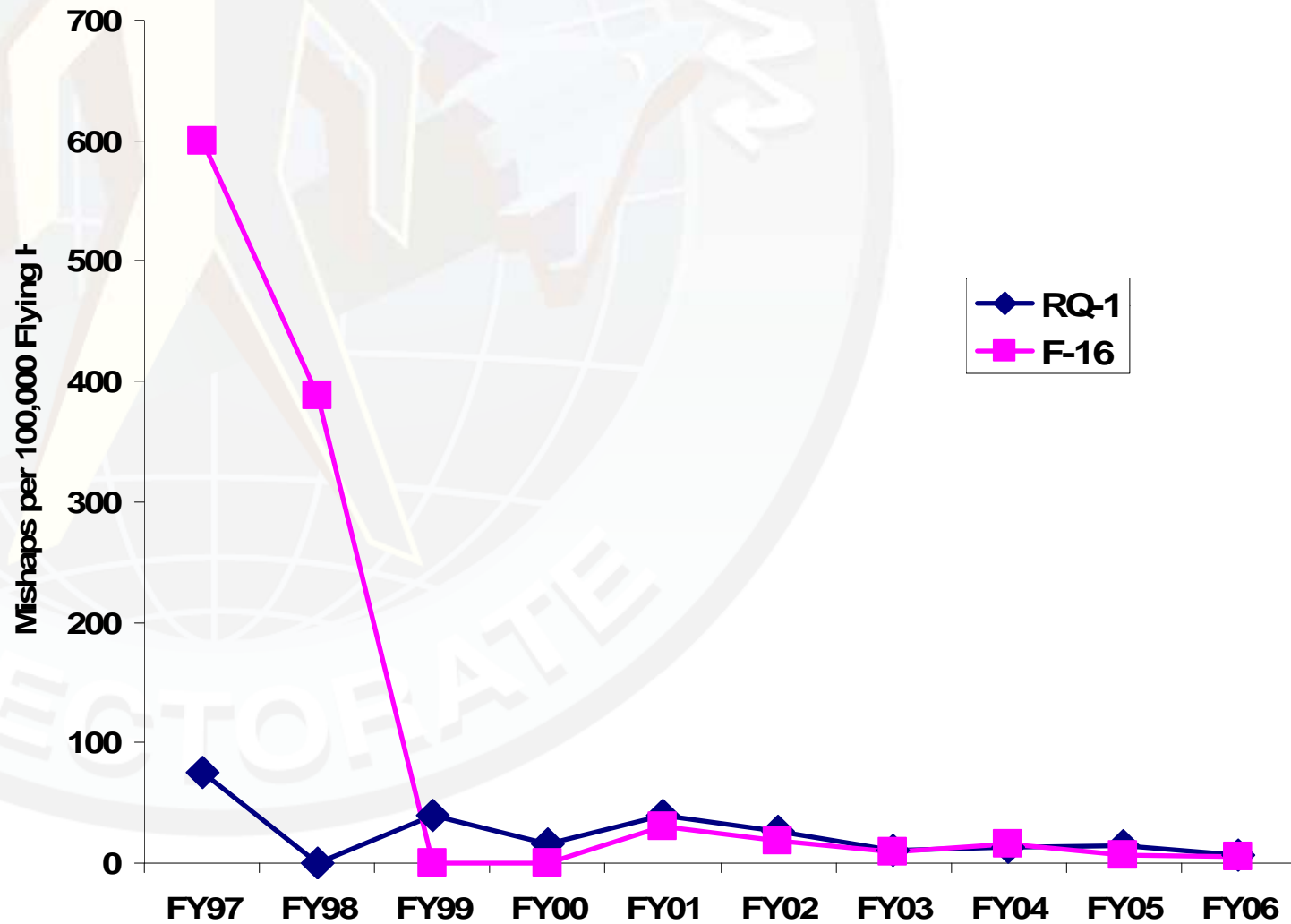
Predator Class A Mishap Rates With F-16 Rates FY77-84



Source: www.afsafety.af.mil



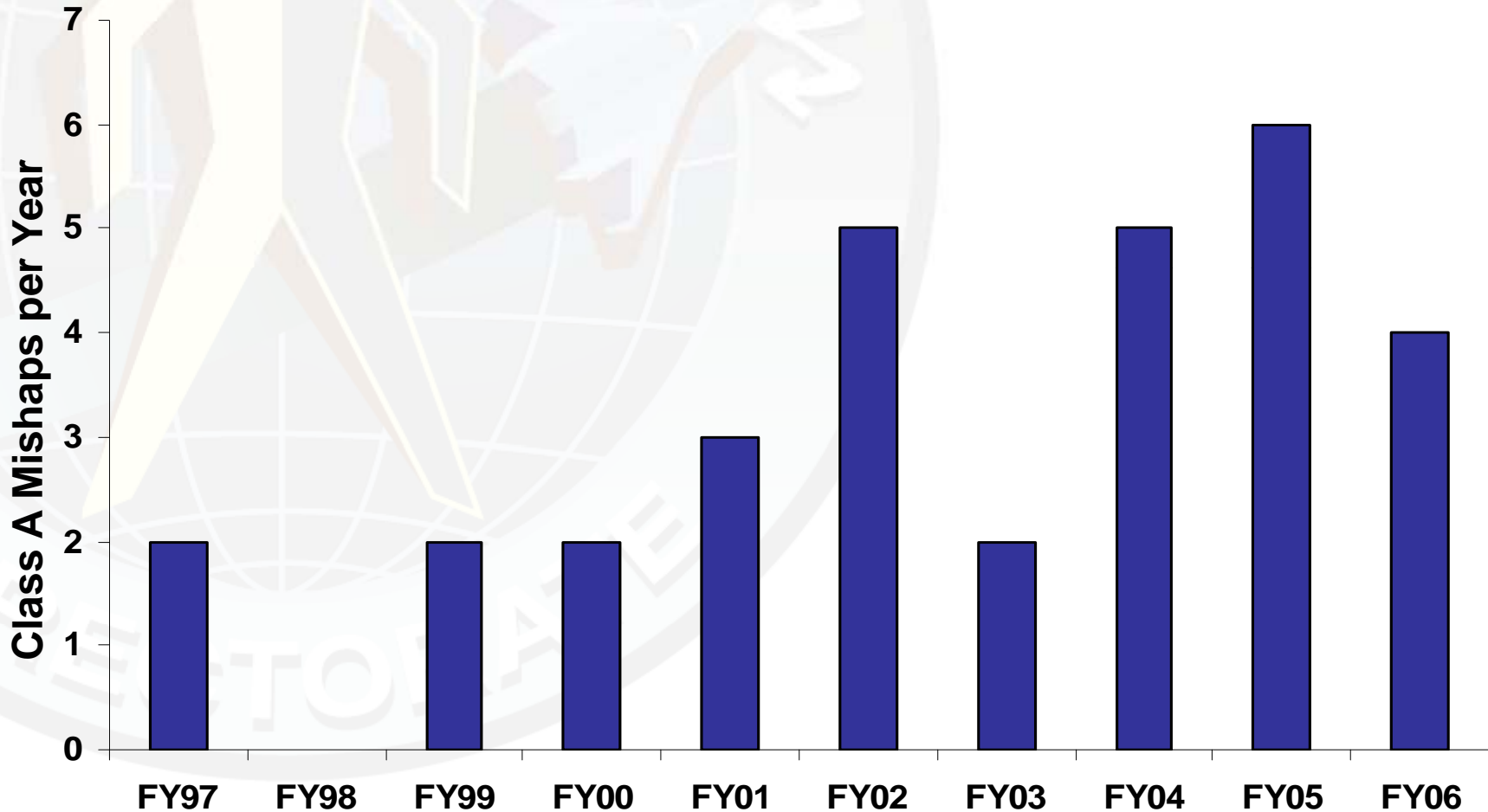
Predator Class A Mishap Rates With F-16 Rates 1973-1982



Source: www.afsafety.af.mil



Predator Class A Mishap Frequencies

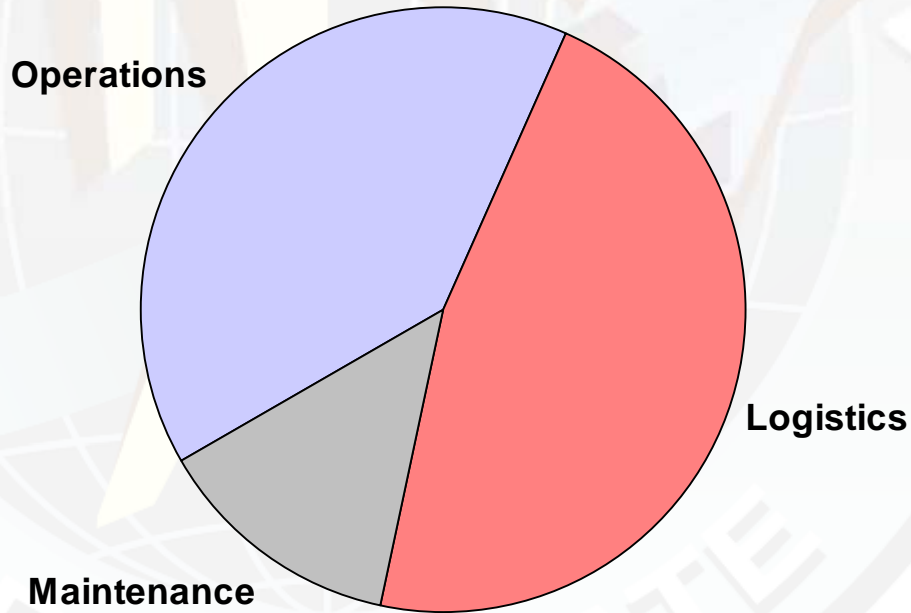




Air Force Predator Class A Mishaps – First Half, Second Half

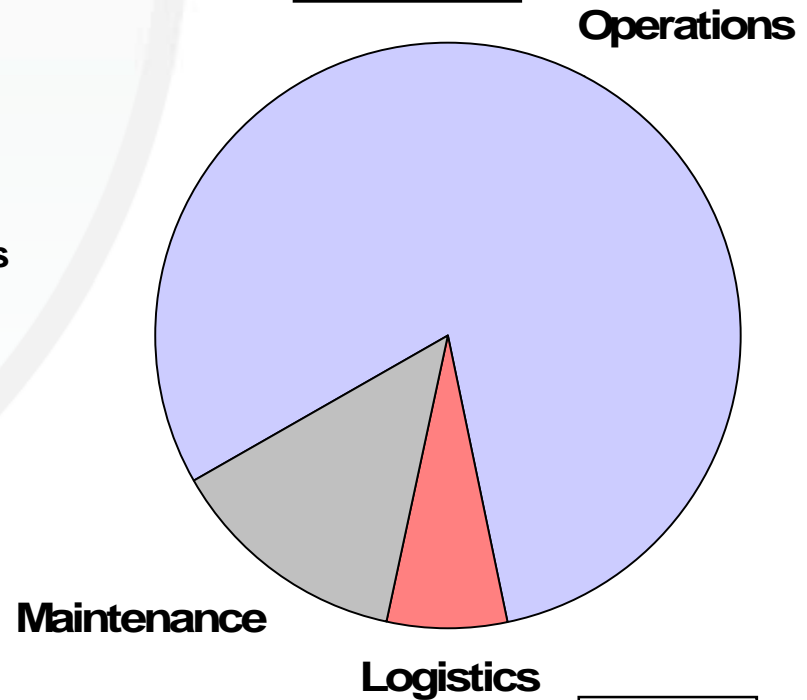


FY1997-
2003



n = 15

FY 2004 -
2006

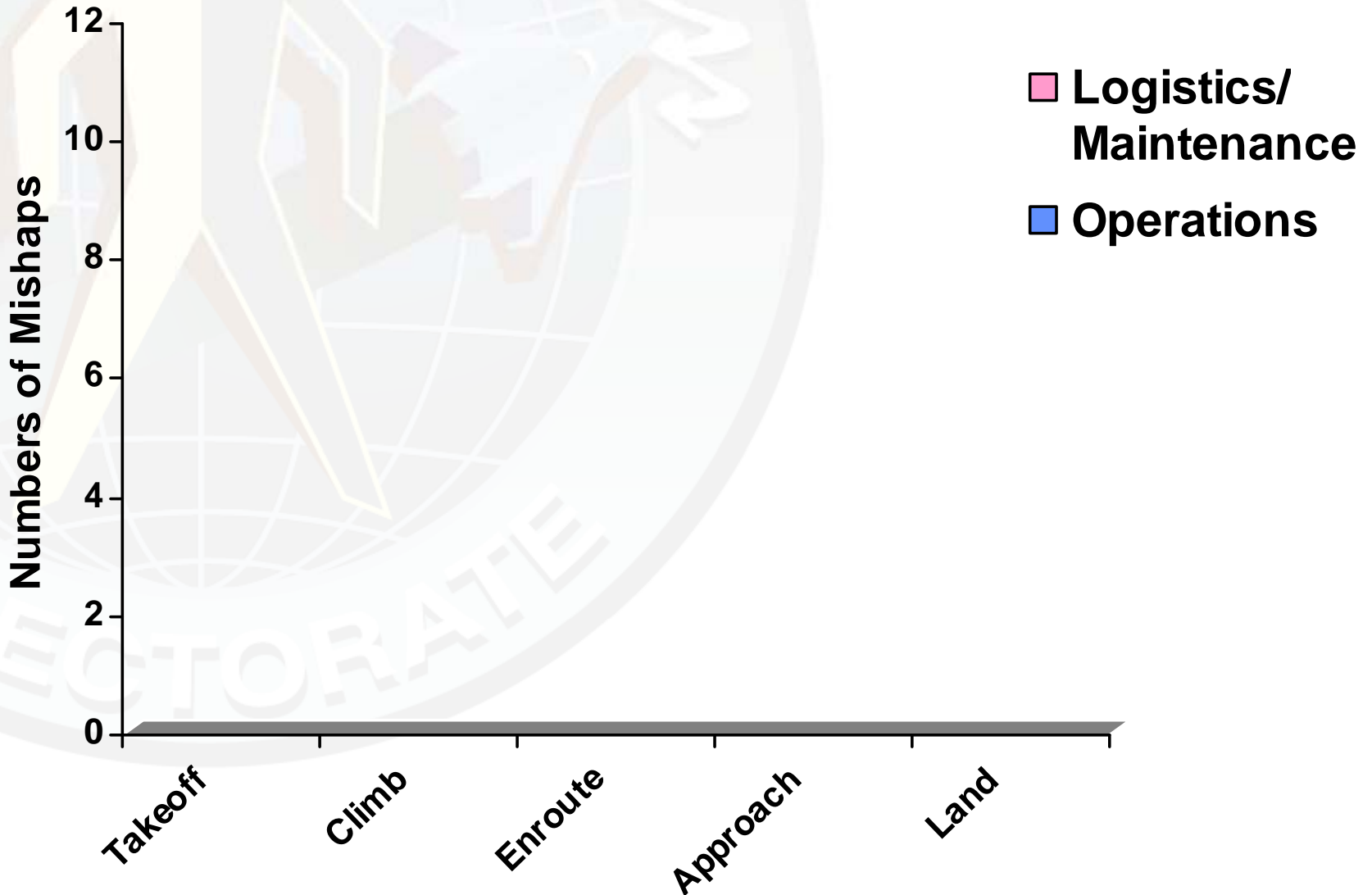


n = 15

Source: Safety Center Mishap Summaries



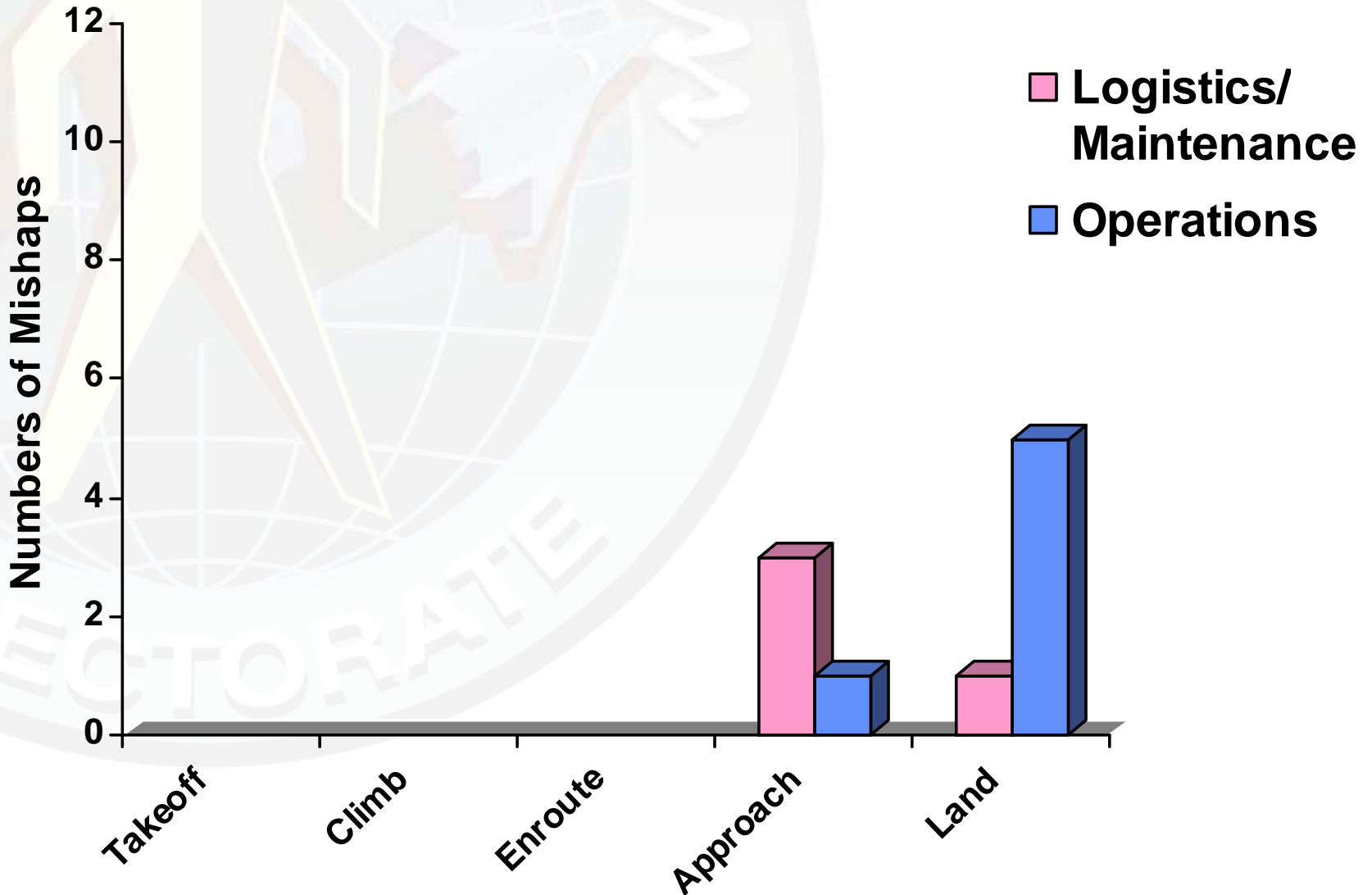
Predator Class A Mishaps by Mission Phase



Source: Safety Center Mishap Summaries



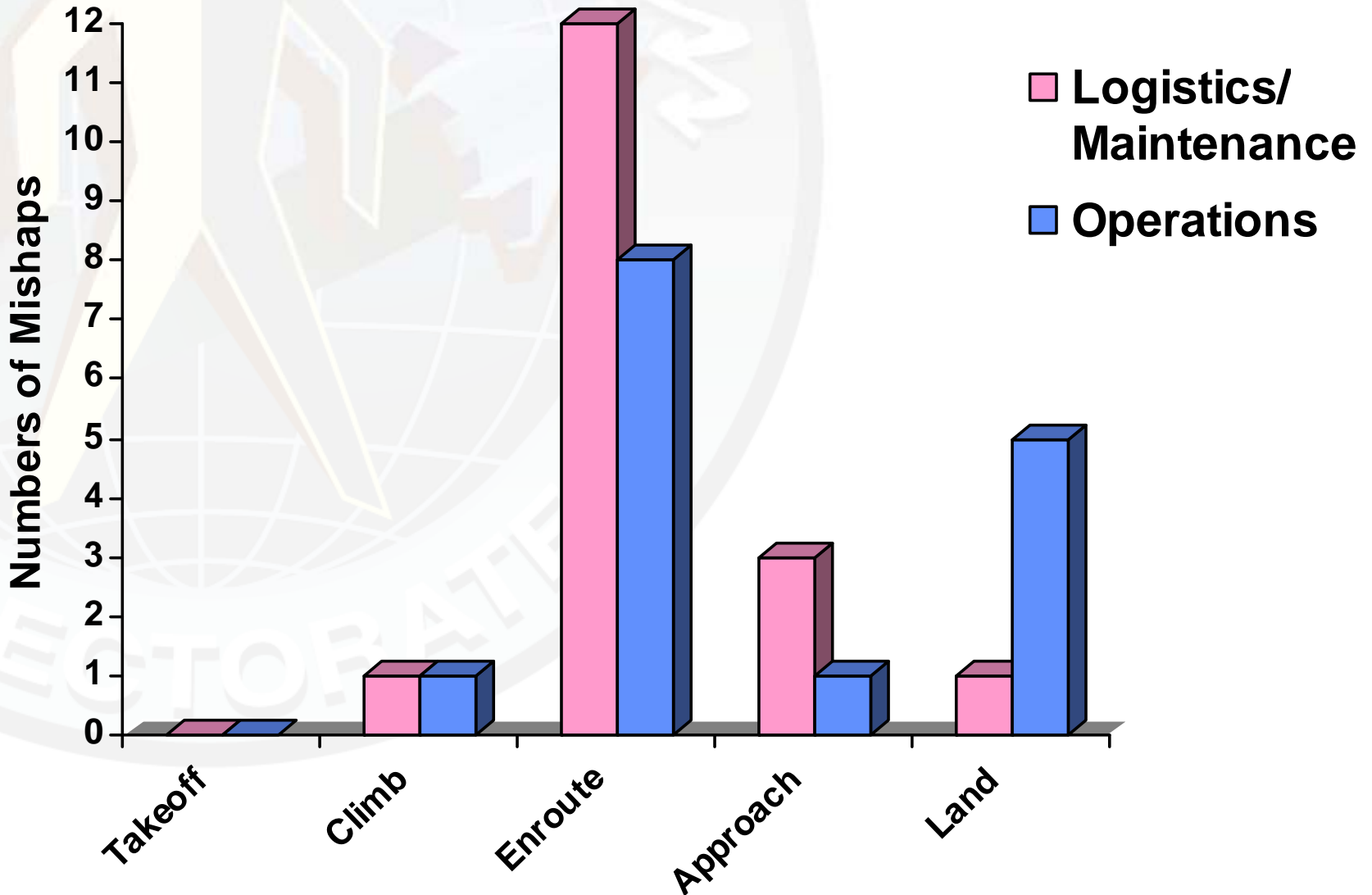
Predator Class A Mishaps by Mission Phase



Source: Safety Center Mishap Summaries



Predator Class A Mishaps by Mission Phase



Source: Safety Center Mishap Summaries

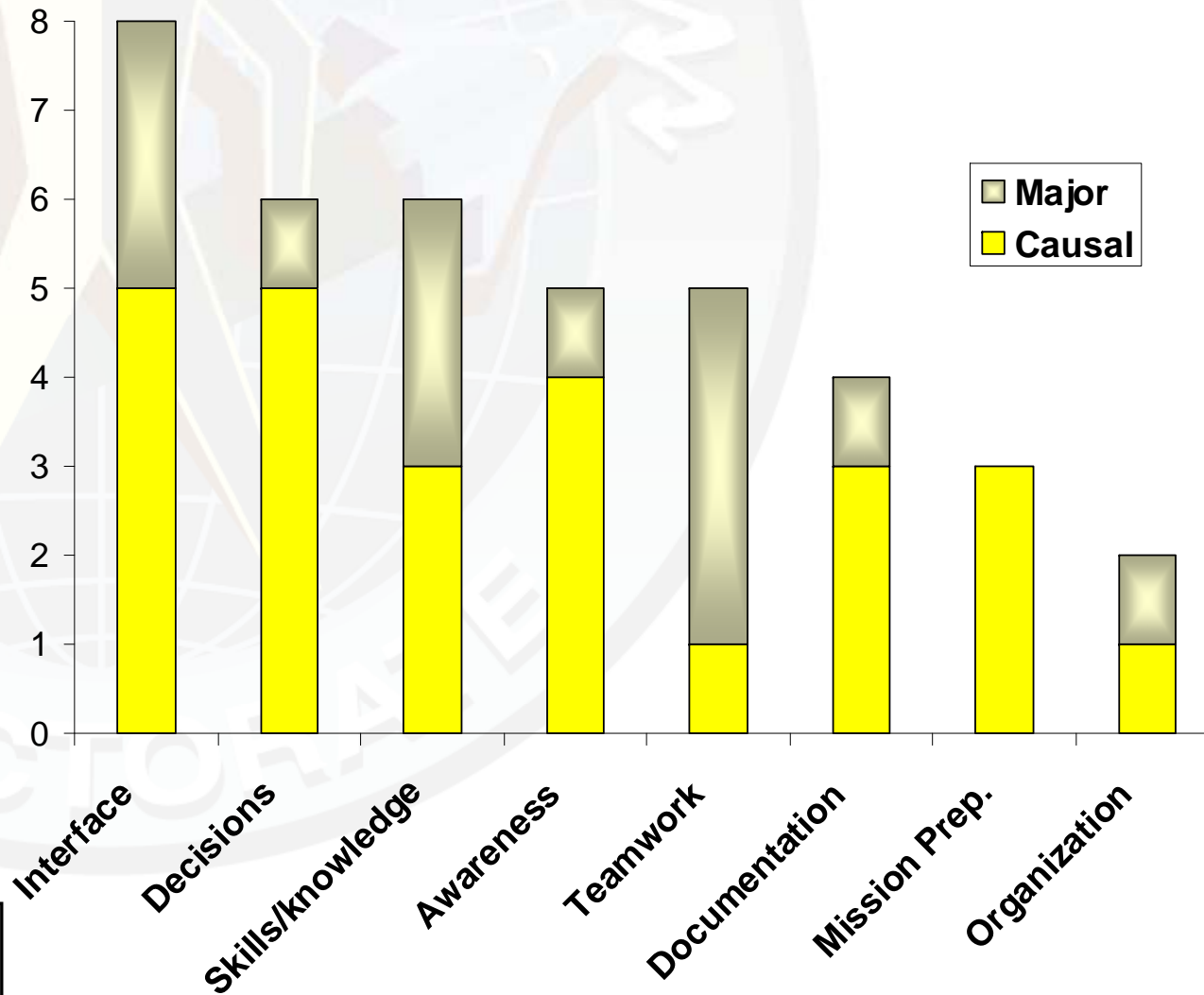


First Half Mishap Human Factors

(1997-2003)



Numbers of
Class A
Mishaps



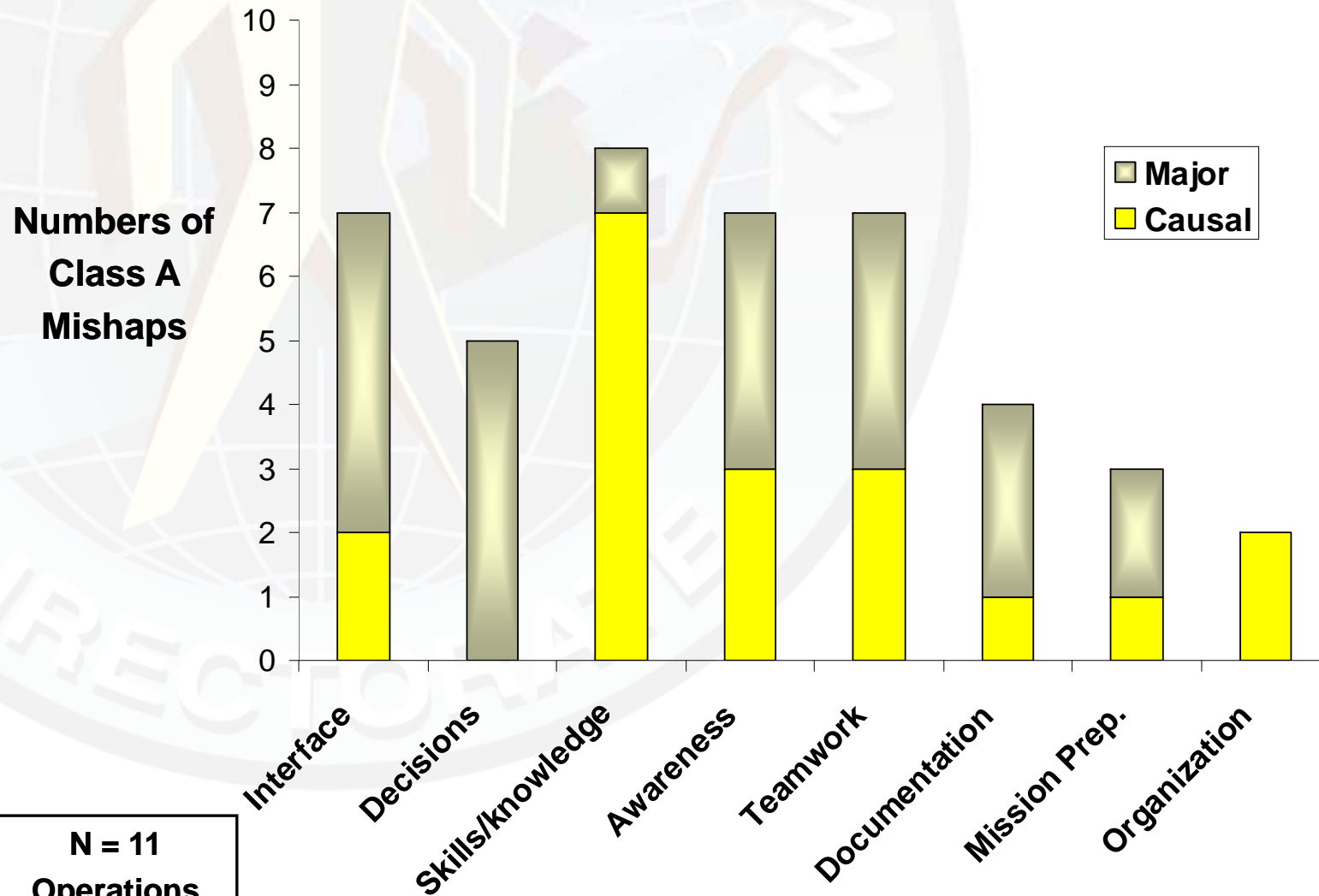
N = 9
Operations
Mishaps

Source: Safety Center Human Factors Database



Second Half Mishap Human Factors

(2004-2006)



**N = 11
Operations
Mishaps**

Source: Safety Center Human Factors Database



Predator Class A Mishap Report Trends



- **Significant shift over time from equipment failure toward operator error**
- **Most mishap reports (63%) cite causal human factors**
- **Legacy CRM skills are common factors**
- **Interface and documentation frequently cited**
- **Some areas seem to be improving**
 - *Fatigue*
 - *Risk assessment*
- **Opportunities to improve remain in other areas**
 - *Skill and knowledge deficiencies*
 - *Channelized attention*
 - *Crew coordination*



Lessons Learned from Manned Aircraft Mishap Analyses



- **C-130, A-10, F-16, H-53, and H-60 mishap reports previously analyzed**
- **Threat and error management (Helmreich's 6th Generation CRM) seems to make sense**
- **Threats to safety can vary considerably across platforms**
- **Unsafe acts leading to human-error mishaps accompanied by active and latent conditions**



The Evolution of CRM Training in Commercial Aviation



- 1st Generation – Cockpit Resource Management (1981)
- 2nd Generation – Crew Resource Management
(Late 1980's)
- 3rd Generation – Broadening the Scope (Early 1990's)
- 4th Generation – Integration and Proceduralization
(AQP, 1993)
- 5th Generation – Error Management (1999)
- 6th Generation – Threat and Error Management (2001)

Most Military CRM Programs

Data Supports This Training Methodology

Helmreich, Merritt, and Wilhelm (1999).
The Evolution of Crew Resource Management training in commercial aviation.
International Journal of Aviation Psychology, 9(1), 19-32

Helmreich (2001). *Managing threat and error*. AFRC CRM Conference presentation.



Characteristics of 6th CRM Training

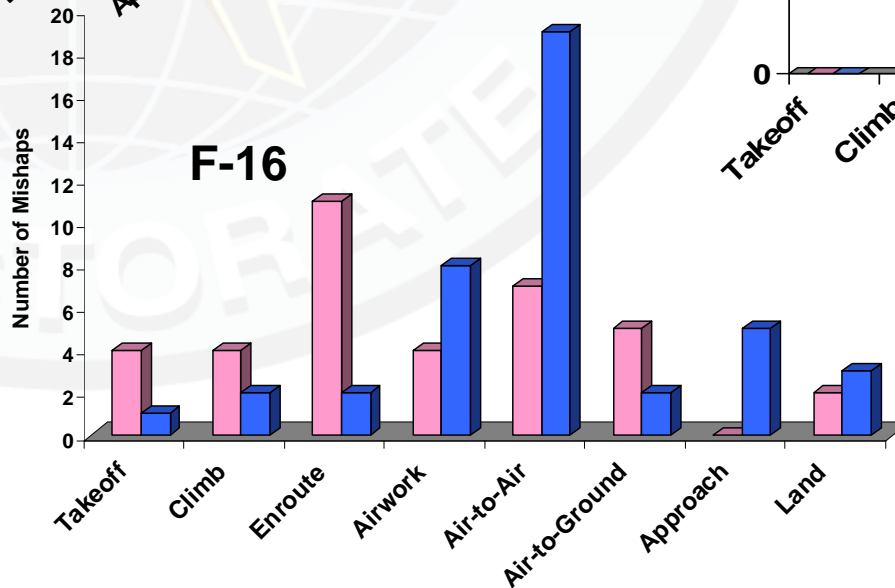
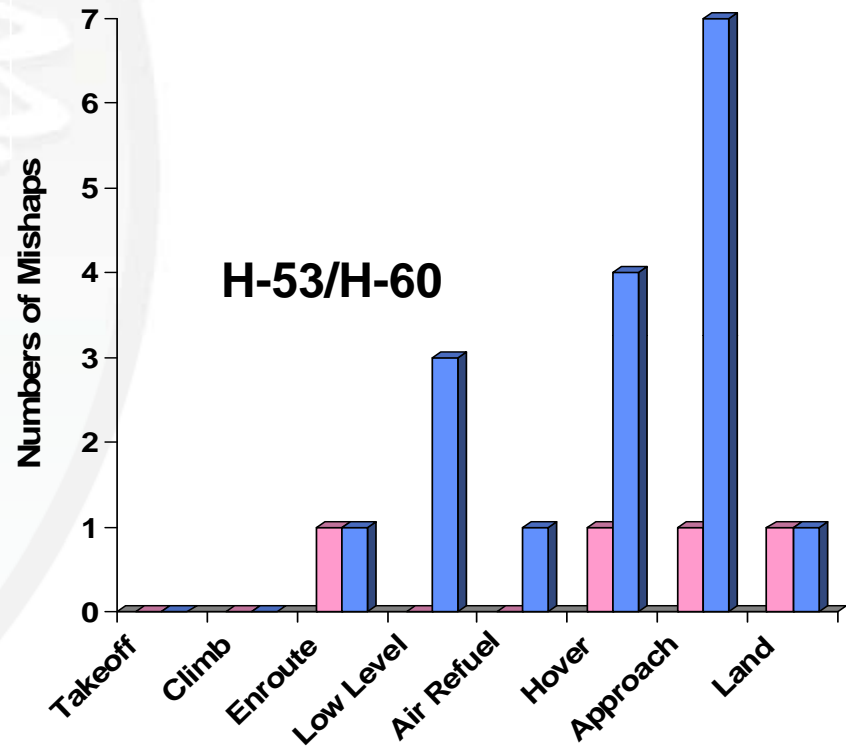
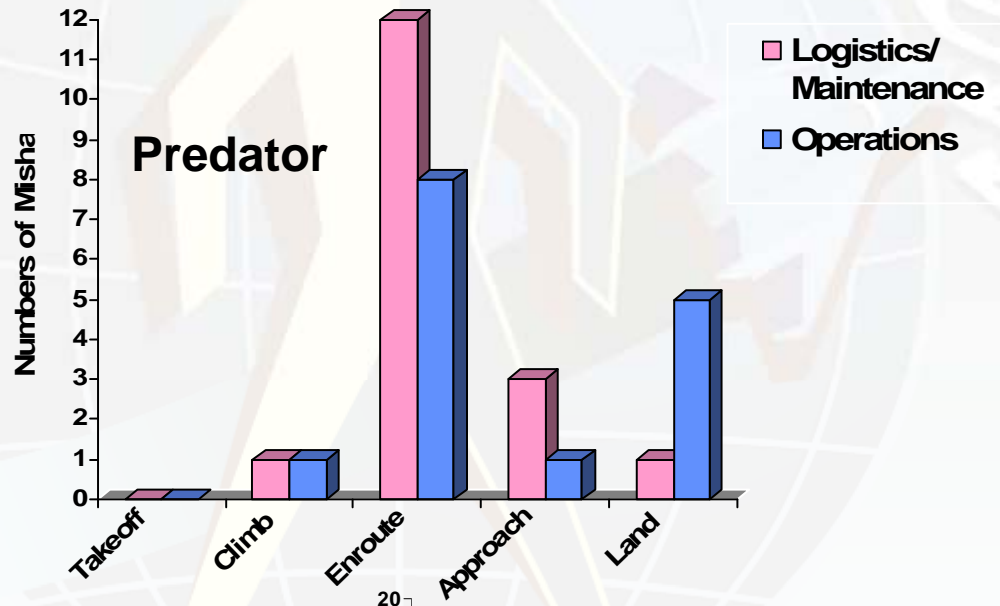
(Bob Helmreich, 2001)



- Threats to safety vary across air carriers
 - Training needs to be based on data from airline's own experience
 - *LOSA*
 - *FOQA*
 - *ASAP*
- Available Military data include flight evaluations, HHQ inspections, training records, safety investigation reports

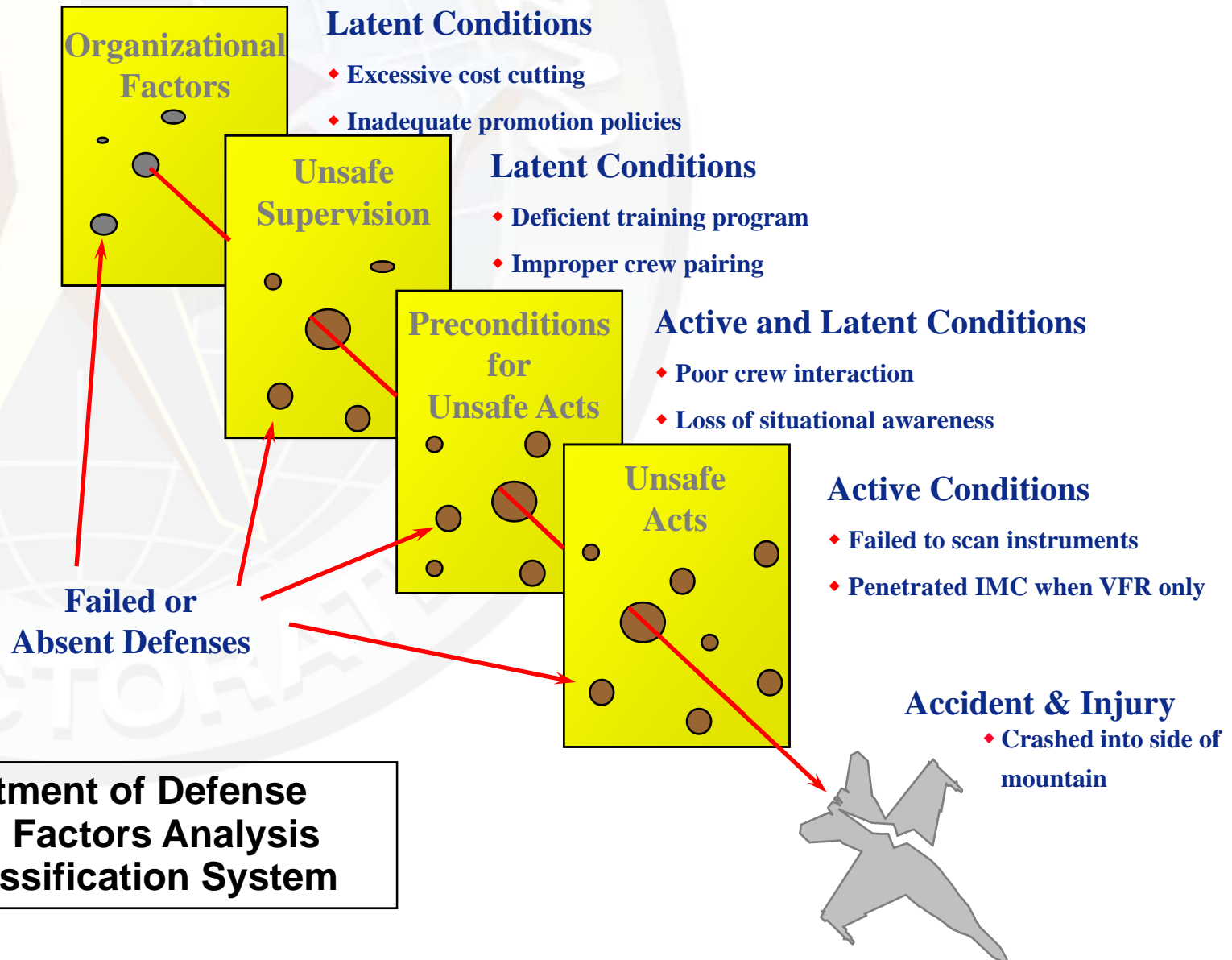


Threats to Safety Can Vary Across Platforms





Human Error Mishaps Involve Multiple Factors





Major UAV Studies using HFACS



- **Tvaryanas, Thompson, and Constable (2005). *U.S. Military Unmanned Aerial Vehicle Mishaps: Assessment of the Role of Human Factors using HFACS.* (see DTIC)**
- **Tvaryanas and Thompson (2006). *Unmanned Aircraft System (UAS) Operator Error Mishaps: An Evidence-based Prioritization of Human Factors Issues.* RTO-MP-HFM-135. (NATO report)**



Next Steps in Predator Analyses



- **Document analyses of legacy mishap factors**
- **Compare and contrast mishap trends using HFACS and legacy taxonomies**
- **Explore experience impacts (30, 60, and 90 day histories; total and Predator flying hours)**
- **Analyze instructor comments in student records**
- **Compare mishap and training record trends**
- **Identify implications for CRM training**
- **Identify implications for training research**



**The Air Force's new flight demonstration team.
Why put Thunderbird pilots' lives at risk?**

The background of the slide is a close-up, slightly blurred image of the American flag, showing the stars and stripes. The flag is waving, and the colors are vibrant. The stars are white on a blue field, and the stripes are red and white.

Questions?

Lt. Col. Robert Herz
480.988.6561, extension 183
robert.herz@mesa.afmc.af.mil

Dr. Bob Nullmeyer
480.988.6561, extension 283
robert.nullmeyer@mesa.afmc.af.mil