Communication in Flights under Crisis: A Conversation Analysis Approach of Pilot- ATC Discourse in Greece and USA

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Introduction

The modern flight aviation system operates as a communication process constructed, organized, regulated, and realized through human actions. Aviation safety is and will remain the central concern of our era, for all people living allover the world. Unpublished and intra-sector data demonstrate that communication problems have indeed cost lives or provoked major incidents. Comprehensive studies of the role of communication in aviation incidents are limited, but they demonstrate how incident data provide insights to accident causes. Incidents are violations of instructions or legal parameters that may or in fact affect the safety of operations. US Federal Aviation Administration (FAA) anonymous Aviation Safety Reporting System (ASRS) reveals over 60% communication problems, in reported cases.

Earlier studies in the 1980s indicate that those communication issues contain problematic information transfer and exchange. Thus, systems approach that is concerned with information flow and sender- receiver perception in the cockpit environment is a contributing factor in the current analysis. Human factors analysis on cognitive interactions in mission critical environments offers another ground to draw on how participants implement their interaction in time constrained conditions. Aviation human factors research describes the goal of all pilots "*to get people from A to B, without disturbing or killing them*". Conversation analysis literature provides a framework of understanding interaction, turn-taking and implementation of processes via communication. Interaction phenomena in the case of cockpit conversation extend common encounters of turn-taking and routine discussions to pressing operating conditions where human actors need to have established interaction relationships and apply disciplined actions to correct errors and follow consequential steps, accomplish cockpit identities and roles. A successful flight is a systems result of the interactional accomplishment of human performance.

Flights as Communication Sessions

Airplane flights are abstract representations of the basic model of communication (Shannon & Weaver, 1948; Wiener, 1954) in an ideal flight session situation. The discursive space of Pilots and Air Traffic Controllers (ATC) is determined by operational structures and cultures, in a highly-mediated environment. Institutional interaction differs from ordinary conversation in sequential organization and actions that actors undertake. The role of ATC actor extends interaction to "outeraction" (Nardi & Whittaker, 2000) when contextual features are negotiated through conversation. Cockpit as a context includes pilots, crew members, tele-present air traffic controllers, technological-mechanical devices and procedures. These participants are roles expressed with talk-in interaction.

From a human factors point of view the importance of understanding routine work, repeated and confirmed actions, practices, and situational requirements of the users in the design of tools and technologies that they use is recognized by several theorists (Norman & Draper, 1986; Winograd & Flores, 1987; Moran & Anderson 1990). NASA researchers analyzed the causes of civil aviation accidents and incidents between 1968 and 1976 (Cooper, White & Lauber, 1980; Murphy, 1980) and concluded that pilot error was more likely to reflect failures in team communication and coordination than deficiencies in technical proficiency. Human factors issues related to interpersonal communication have been implicated in approximately 70%- 80% of all accidents over the past 20 years, especially in the issue of task management (Iani C. & Wickens C. D., 2007). Consequently, more than 70% of the first 28,000 reports made to NASA's

Aviation Safety Reporting System (ASRS, which allows pilots to confidentially report aviation incidents) were found to be related to communication problems (Connell, 1995). Studies of collaboration among scientific and professional communities suggest that an initial period of physical proximity is necessary in order to build trust and to come to consensus on the focus of proposed goals and projects (Carley & Wendt 1991).

The International Civil Aviation Organization (ICAO, 1998) has embraced a systems analysis approach while people have become instrumental in aviation safety in an analogous of a “liveware” in the cockpit (Edwards, 1988) and stakeholders beyond that cockpit towards the air traffic controller. The European Air Traffic Management (EATM), known as Eurocontrol, issued its guidelines for best practices in 2007, introducing the human factors pie that follows:

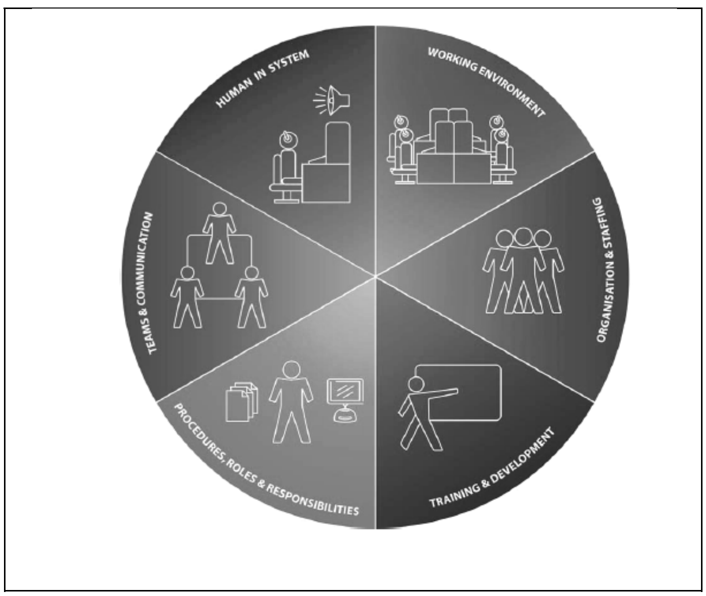

Figure 2: The Human Factors Pie EATM (2007)

This is a complete systems view of a systems working environment with the human actor, in team work accomplished via communication, applying procedures- roles and responsibilities cultivated in training phases that develops staff necessary to populate and operate an organization around the clock, with appropriate transition and vigilance when shifts change.

Team collaboration is disclosed in versed dialogic exchange of interactions that is efficient only when all human actors share a feeling of trust without question. There is a broad agreement on trust in automotive environments where accuracy of information is crucial in building and retaining trust. Proposed benefits of trust include better task performance (Golembiewski & McConkie 1975) and the ability to cooperate (Deutsch 1962; Argyle 1991). There are a number of taxonomies for trust in human-machine communication and interaction (Barber 1983; Rempel, Holmes et al. 1985; Muir 1987; Muir 1994). These taxonomies tend to distinguish three categories of trust (Lee and Moray 1994): (1) observed consistency of behavior, persistence or predictability; (2) belief in competence or dependability; and (3) faith in purpose or obligation, confident responsibility or faith. While faith-based trust is difficult to establish for machines, these taxonomies suggest that trust by consistency and competence can be achieved by explaining the purpose, capability, and reliability of the process (software and information flow in the cockpit) or the system to the users-actors. Thus, when human actors operate mechanical and communication devices in flights they have to build trust in a mutual manner with all the other human actors, in each stage of a flight mission.

The cockpit system has to be tolerant to function and accomplish the mission even when fault occur. Most airline accidents are attributed to errors made by the flight crew (Loukopoulos, 2001; 2003; 2009). One of the greatest challenges in aviation operation and accident investigation is the uncovering of the causes of such an error, as many factors intermingle. That is why a flight mission should be represented via its communication events, as interactions that materialize the intangible reality of a flight. Communication has long been suggested as a critical issue in all aspects of human interaction. Most testimonies in ASRS and National Transportation Security Board database illustrate how critical communication is in aviation and aviation safety, from the cockpit-controller interface to coordination in the cockpit to cockpit-cabin interaction to the management of safety and creation of a safety culture (Krinovos, 2007). Communication has a multi-faceted nature with a variety of settings and situations. Kanki and Palmer (1993) provide a useful structure for the functions communication plays in aviation and aviation safety, especially as it affects crew performance: communication provides information, initiates interpersonal relationships, establishes predictable behavior patterns, maintains attention to task and monitoring, and it is a management tool.

Cockpit conversation is a very important starting point for any investigation in any aviation failure. The new view of human error has its origin to Fitts (1947) who stressed aviation human factors to examine 460 “pilot error” occurrences, considering them as systematic and connected to cockpit layout. Following this analysis, as described by Dekker (2006), we need to find how actors’ assessment make sense at a time, given the surrounding circumstances encountered in a complex system with multiple, sometimes irreconcilable goals. Furthermore, when cockpit communication actors interact speaking in one language (English) but thinking maybe in their own mother tongues (like Greek) then meaning-making may extend from language relativity (Sapir-Whorf, in Caroll 1956) to meaning of words habitat (Pinker, 2007).

The systems view of the cockpit emphasizes the assemblance of parts, facts, principles and processes forming a unitary whole with human actor operators- interactants. The entity of a cockpit is composed of a set of primitive concepts and formalized rules and criteria that determine when concepts apply. On the other hand, typical instances can be compared to specific phenomena to access similarities and differences. In the systemic view of the cockpit, the latter approach is applied when actor- members are practicing what they have learned through training, where as the former conceptualizes knowledge embedded in mechanical parts and expertise in “doing something based on knowing something” and not vice versa.

In the current proposal, the cockpit meets the system complexity hierarchy that takes predeterminism, self consciousness and language to connect it with the operational sociocultural environment where actors conceptualize rules that operationalize roles, values, and mainly trust in all instrumental parts. Control hardware devices provide messages, signals and symbols that are considered dependable and the human actors provide feedback actions forward, interpret and exchange signals to continue the flow of information that governs each flight. That is why in the collective work of a cockpit in flight, the pilot evolves from an expert to a decision maker (Kohan, 2010) and the Air

Traffic Controller to a gatekeeper of meaning making. Human actors in the cockpit perceive messages from mechanical channels, interpret voice signals received from communication channels and follow rules of compliance imposed by the Air Traffic Controller.

Information based conversation analysis in the cockpit incorporates a cultural account of human action (Hofstede G., 1980; Hofstede G. & Hofstede J, 2004). This focus on conversation, as communicative use of information by the human actors, outgrows the traditional Computer – Supported Cooperative Work (CSCW) situations (Monteiro, 2004). Computers and communication devices in the cockpit are artifacts with purposes following the designer's intentions but also the intentions of the machine (Suchman, 2009), to be responsive to the others' actions. Analyzing this interaction is expected to provide useful insights on those operational requirements. Air communication or air-ground communication is mainly using voice-mediated language (Cushing, 1994).

Methodology of CA

Conversation analysis (CA) studies all kinds of conversation. It puts under the microscope anything from schizophrenia diagnosis to answering questions in court, and from talking over family matters at dinner to guiding a pilot through fog. All are done through talk and talk-in interaction.

So "conversations" studied are not just the casual chat among friends - though the conversation analyst is interested in those too- but those utterances in social life, business life, healthcare, education, leisure, politics, mission critical occupations and aviation. CA is an established discipline, developed since the pioneering work in the 1960s by sociologist Harvey Sacks (1992). When language is used in interaction it brings in light subtleties that are often invisible or routine from a more "common-sensical", straight-down perspective.

In the case of cockpit communication, where ATC is included, talk makes things happen, and the conversation analyst has the goal to identify and explain something about how (Atkinson & Heritage, 1984; Hutchby & Wooffitt, 1998). CA seeks to focus on behavioral, and not cognitive or internal, elements of talk-in-interaction. In the current proposal we investigate the situated concerns of interactants inside the physical cockpit, focusing on its virtual aspect when ATC is included and the flight mission could be in the military aviation or civil aviation, when a crisis is observed, unfolds or is under resolution. Furthermore, the current study will incorporate cases for different aviation systems that start from different mother tongues, in order to indentify the effect of linguistic factors in effective communication under pressure.

Ethnomethodological inquiry treats social facts as accomplishments (Garfinkel, 1967). Ethnomethodology deals with the "process" instead of "things', "givens" or "facts of life"; it is the process of creating and sustaining stable features of socially organized environments. In traditional anthropological studies "tribe" is used to disclose an evolutionary stage, to define one society from others and to label and "ethnos", as any population with members sharing a common culture. The ethnos examined in the current proposal consists of cockpit participants, as well as ATC members that communicate with them. They all share aviation culture in terms of flight mutuality.

CA is really involved with the organization of turn-taking in conversation, starting its tradition with Sacks, Schegloff & Jefferson (1974) that studied the organization of turn-taking in conversation. Introducing the idea of "mundane conversation" they described the formative sense of variable turn form, turn content, and turn length as variable parameters referring to: a) what people have to say b) how they say it and c) the length of the turn they say it. In the case of cockpit conversation this proposal is expected to bring light to fixed turns, formalized lengths and standardized content may be observed, as well as deviance from the protocol, intense turns to correct errors that are consequential (without associating them with previous interactions), as well to how "awareness of the immediate" guides paired- versed interaction that need to react to instant realities.

Sacks et al (1974) in their studies noted that conversation is factual when turn-taking occurs, one speaker talks at a time, and turns are taken with small gaps or overlaps when possible. Turn- taking includes turn-construction and turn-distribution. In the case of cockpit conversation the current study is expected to show how projectability and transition-relevance are accomplished with much inter-speaker coordination. Also, how orientation to rules is displayed and what are the situated practices that require expertise to resolve erroneous communication and accomplish interactions that have to be fault-resolvable and not just fault-tolerant. Cockpit interactants share a mutual subjectivity that is negotiated to establish an intersubjectivity of their own awarenesses while they constantly encode-decode messages "behind observable phenomena of speech" (Hutchby, 2001).

Analysis of Data and Inquiries

This proposal applies ethnomethodology (Psathas, 1990; Sacks, 1992) to approach empirical interaction in flights characterized with an event *('συμβάν')* or crisis *('μείζον συμβάν')* using transcripts of real crisis/accident cases reported in Hellenic Civil Aviation Authority (HCAA), as well as typical interception conversations revealed for the first time. The Greek case is important as Greece resides in the eastern borderline of the European Union, operates 40 airports in a population of 11 million people and Hellenic Air Force (HAF) estimates 3,500 hours of interceptions per year, coupled with countless readiness, briefing and de-briefing hours.

On the other hand, international and domestic civil aviation flights are crucial for the country due to its geographical location, island configuration and economy and to the fact that it remains a popular destination for in-coming visitors. The spread of airports is represented in the following figure:

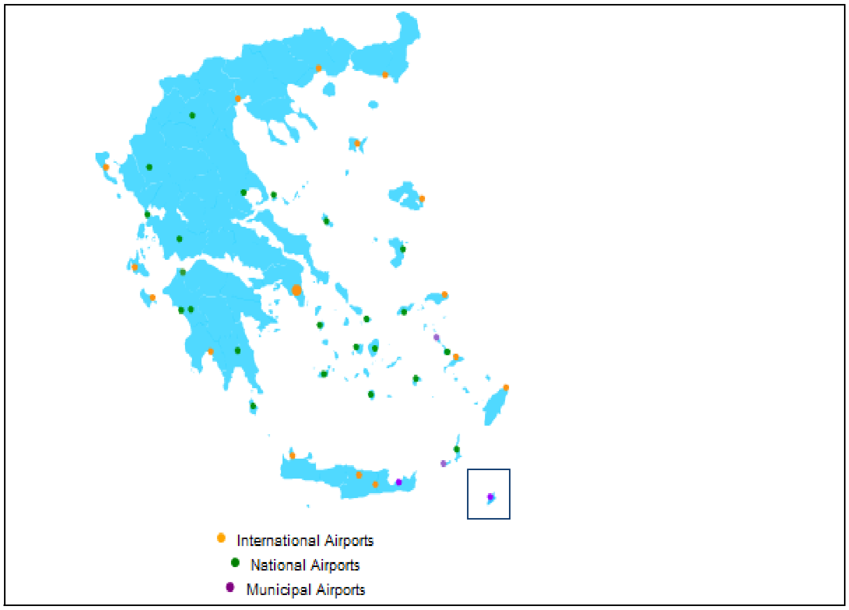

Figure 1a: The Importance of Aviation in Greece (as of HCAA)

International Airports	National Airports	Municipal Airports
• Athina Airport ´El.Venizelos´	• Ioannina Airport ´King Pyrros´	
• Thessaloniki Airport ´Makedonia´	• Chios Airport ´ Omiros ´	• Kasos Airport
• Rodos Airport ´Diagoras´	• Mykonos Airport	• Leros Airport
• Heraklion Airport ´N.Kazantzakis´	• Skiathos Airport ´A.Papadiamantis´	• Sitia Airport
• Kerkyra Airport ´Ioannis Kapodistrias´	• Kozani Airport ´Filippos´	• Kastelorizo Airport
• Kos Airport ´Ippokratis´	• Agrinio Airport	
• Alexandroupoli Airport ´Dimokritos´	• Kastoria Airport ´Aristotelis´	
• Mytilini Airport ´Od.Elytis´	• Karpathos Airport	
• Limnos Airport ´Ifestos´	• Santorini Airport	
• Chania Airport ´I. Daskalogiannis´	• Kythira Airport	
• Kefallinia Airport	• Milos Airport	
• Zakynthos Airport ´D.Solomos´	• Skyros Airport	
• Samos Airport ´Aristarchos of Samos´	• Nea Anchialos Airport	
• Kavala Airport ´M.Alexandros´	• Aktio Airport	
• Kalamata Airport	• Sparti Airport	
	• Paros Airport	
	• Andravida Airport	
	• Epitalio Airport	
	• Syros Airport ´Dimitrios Vikelas´	
	• Astypalaia Airport	
	• Araxos Airport	
	• Kasteli Airport	
	• Naxos Airport	
	• Kalimnos Airport	
	• Ikaria Airport ´Ikaros´	
	• General Aviation Services Unit-Pahe M.E.G.A.P	

Figure 1b: Airport Categories in Greece (as of HCAA)

In an extensive search in HCAA and with full cooperation of Captain Akrivos Tsolakis and his team, several aviation incidents were discovered with the criterion of having an attribution to communication. Indicative crisis cases are: US1549 flight in Hudson River, HCY 522 or ZU522 in Helios Flight from Cyprus, Falcon 900B SX-ECH flight with late Alternate Minister Kranidiotis in Romania, Yakovlev Yak-42 as well as the deadliest aviation accident, the Tenerife Crash (1977).

An unmanned flight that is considered in the data is shown in Figure 2 (emphasis added):

...

The AC-130 radioed the Predator crew in Nevada: "It appears the two vehicles are flashing lights, signaling." With that, the travelers became targets of suspicion. **At Creech Air Force Base, 35 miles northwest of Las Vegas, it was 4:30 p.m., nearly dinner time.** A few hours earlier, a dozen **U.S. special operations soldiers, known as an A-Team**, had been dropped off by helicopter near Khod, five miles south of the convoy. The elite unit was moving on foot toward the village, with orders to search for insurgents and weapons. Another U.S. special operations unit had been attacked in the district a year earlier, and a soldier had been killed. **This time the AC-130, the Predator drone and two Kiowa attack helicopters were in the area to protect the A-Team.**

The Predator's two-man team - a pilot and a camera operator - was one of the Air Force's most-experienced. The pilot, who had flown C-130 cargo planes, switched to drones after 2001 and had spent more than 1,000 hours training other Predator pilots. **Also stationed at Creech were the Predator's mission intelligence coordinator and a safety observer. In addition, a team of "screeners"** - enlisted personnel trained in video analysis - was on duty at Air Force special operations headquarters in **Okaloosa, Fla.** They sat in a large room with high-definition televisions showing live feeds from drones flying over Afghanistan. **The screeners were sending instant messages to the drone crew, observations that were then relayed by radio to the A-Team. On the ground, the A-Team was led by an Army captain, a veteran of multiple tours in Afghanistan. Under U.S. military rules, the captain, as the ground force commander, was responsible for deciding whether to order an airstrike.**

The Predator crew and video analysts in Nevada remained uncertain how many children were in the group and how old they were. *"Our screeners are currently calling 21 MAMs (military age males), no females, and two possible children. How copy?" the Predator pilot radioed the A-Team at 7:38 a.m.* "Roger," replied the A-Team, which was unable to see the convoy. "And when we say children, are we talking teenagers or toddlers?" The camera operator responded: "Not toddlers. Something more towards adolescents or teens." "Yeah, adolescents," the pilot added. "We're thinking early teens."At 7:40 a.m., the A-Team radioed that its captain had concluded that he had established "positive identification" based on "the weapons we've identified and the demographics of the individuals plus the ICOM." Although no weapons had been clearly identified, the pilot replied: "We are with you." "We'll pass that along to the ground force commander," the A-Team radio operator said. "Twelve or 13 years old with a weapon is just as dangerous." ...

Figure 2: Unmanned Predator Drone Transcript at http://documents.latimes.com/transcript-of-drone-attack/ U.S. military transcript of the radio transmissions and cockpit conversations that Feb 21, 2010day, obtained by the LA Times through a Freedom of Information Act request (April 2011, USAF).

Understanding communication error, in vocalization or content, is a crucial step to improve flight safety. Barshi (1997) used a cognitive/psycholinguistic approach to analyze natural language, message length, speech rate, and intonation. In Simmons experiments (1978), ATC and pilots take a calm and relaxed-sounding voice as highly regarded, due to its transmitted intelligibility, trust and confidence. Specific crisis cases have been acquired to explain the order/organization/orderliness of speech actions in discursive practices of aviation actors in emergency preparedness or resolve. Figure 3 contains an excerpt of the iconic flight that “landed” on NY Hudson River.

N90-TRACON-0122
AWE1549

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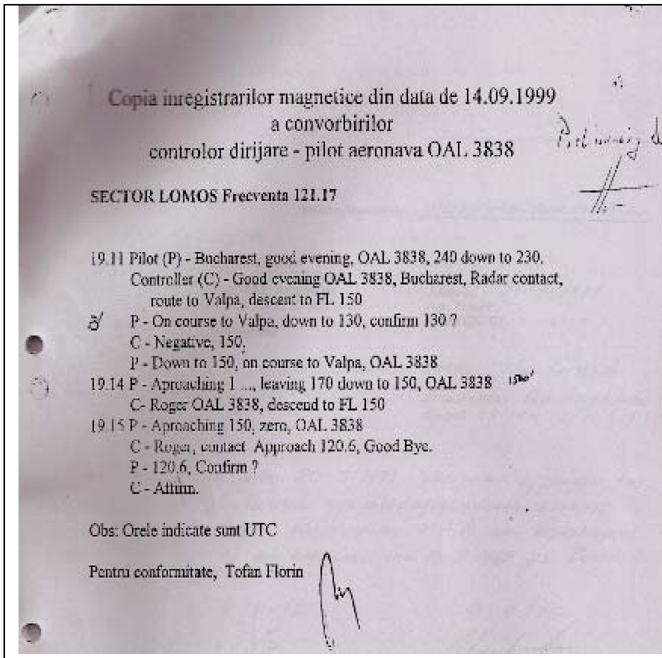
2029:17	L116	ah yes he ah he was a bird strike can i get him in for runway one
2029:19	TEB	runway one that's good
2029:21	L116	cactus fifteen twenty nine turn right two eight zero you can land runway one at teterboro
2029:25	AWE1549	we can't do it
2029:26	L116	okay which runway would you like at teterboro
2029:28	AWE1549	we're gonna be in the hudson
2029:33	L116	i'm sorry say again cactus
2029:41	L116	jetlink twenty seven sixty contact new york one two six point eight
2029:45	BTA2760	twenty six eight jetlink twenty seven sixty

Figure 3: An Excerpt of transcription of flight US1549 (New York Terminal Radar Approach Control Facility, Jan 15, 2009)

Accident investigation, aviation human factors, situation awareness are sectors to benefit from a communication look in human performance. Situation awareness, workload, stress and trust, human error and reliability, decision making and problem solving are elements of human factors that are negotiated in flight conversation creating social affordances (Gibson, 1977) of aviation conversation. In cockpit situations, “time” is used as a Gibsonian resource affecting decisions and speech acts of all cockpit interactants. A characteristic case of a mission critical real situation is the tragedy with the “dolphin movement” of the Greek Prime Minister’s Falcon in 1999:



Copia inregistrarilor magnetice din data de 14.09.1999
a convorbirilor
controlor dirijare - pilot aeronava OAL 3838

SECTOR LOMOS Frecventa 121.17

19.11 Pilot (P) - Bucharest, good evening, OAL 3838, 240 down to 230.
Controller (C) - Good evening OAL 3838, Bucharest, Radar contact, route to Valpa, descent to FL 150
P - On course to Valpa, down to 130, confirm 130 ?
C - Negative, 150,
P - Down to 150, on course to Valpa, OAL 3838
19.14 P - Aproaching 1 ..., leaving 170 down to 150, OAL 3838
C- Roger OAL 3838, descend to FL 150
19.15 P - Aproaching 150, zero, OAL 3838
C - Roger, contact Approach 120.6, Good Bye.
P - 120.6, Confirm ?
C - Affirm.

Obs: Orele indicate sunt UTC

Pentru conformitate, Tofan Florin

Figure 4: Final Approach of Greek PM's FALCON 900B- SX-ECH ("jet upset") in Romania (Sep 14, 1999)

One set of problems involves issues of reference, repetition, ambiguity, sequence breaking, and the like. A second set of problems concerns the implementation of SOPs/RoE. The comparison of US and Greek transcripts/cases will inform our understanding on mediated Greek language and will explore strategic crisis management communication, introducing testimonies and restricted-access data, for the first time.

Although, there are highly detailed SOPs, what counts as following them in a crisis situation is not always clear, and sometimes not to be followed at all. All of these problems need to be negotiated in time-critical situations. It will be the purpose of this dissertation to examine how this is done, how, for example, pilots and air traffic controller's talk, interact, and *outeract* with orderliness; how they engage in conversation repair; and how they negotiate whose interpretation of an SOP will prevail. Also, in the process, it will be examined how inner and *outer* identities and culture are sustained in crisis conversation. Additional transcripts acquired from Federal Aviation Administration, as well as landmark cases or air-incidents in US and Greek airspace are used to provide a comparison pool. Structured interviews on selected questions are developed to reflect expert users' opinions on ATC- Pilot discourse: fighter pilots of two HAF Squadrons, members of HCAA, and Air Traffic Controllers.

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"Flight Safety in Combat Training: A revised pilot's error framework for EU Air Forces"

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Abstract – Denial or failure of an organisation to improve its processes can cause nonconformities and defects. The purpose of this paper is to present an ongoing research for military aviation organisations in order to further improve flight safety and safety culture. The requirement is a revised, more comprehensive military pilot's error framework. The intent is to start to bridge and compare existent mostly reactive, Flight Safety programmes among NATO/EU Air Forces and show how a more proactive and predictive Safety Management System can be realised. The thesis outcome aims to produce and document meaningful recommendations for military operators to begin addressing the overall problem of flight safety, by equipping them with a standard template for managing all safety risks affecting military aviation organisations to remain at an acceptable level of safety (ALoS) or to a level as low as reasonably practicable (ALARP).

Overview

The aim of this paper is to present the concept methodology used for a scientific multi-national research in order to further improve flight safety and safety culture in NATO/EU Air Forces. (NATO/EUAF). The requirement is a revised, more comprehensive military pilot's error framework. The intent is to compare existent, mostly reactive, Flight Safety programmes among NATO/EUAF and show how a more proactive and predictive Safety Management System (SMS) can be implemented neither with nonconformities nor potential defects. As a first step, in what will be a quality improvement process, this dissertation will defend that for such military organisations that train their own pilots, pilot performance must be mostly viewed in terms of the organisational context in which it takes place (Heinrich et al. 1980).

Besides, this paper argue that although the existing aviation safety agencies regulations, guidance's and applications are mainly directed to civil aviation authorities, a plethora of those may be as well applicable and mandatory to military organisations. A core, international civil aviation organisation (i.e. ICAO) is beginning to require through productive cooperation, coordination and exchange of ideas and data, the implementation of effective Safety Management Systems (SMS) by providing to civil aviation authorities all the necessary tools for the related training courses. On the other hand, prestigious NATO/EUAF have proposed and established over the years numerous other Safety Programmes, Safety Cases and Operational Risk Management (ORM) models for developing flight safety in combat training, defining and aligning competitive advantage. As a result, this research will focus initially to provide an overview and comparison of selected "well-liked" models used in the development and appraisal of NATO/EU national's defence flight safety models, as well as, a brief discussion of schools of aviation agencies thought and theory. Taking into consideration the available literature reviews and the provided access to several defence organisations, various selected flight safety models and tools will be compared systematically for the first time in one single dissertation.

With the aim to produce and document meaningful recommendations to enable military operators to begin addressing the overall problem of achieving an acceptable level of Safety (ALoS) or to a level as low as reasonably practicable (ALARP), the potential thesis will examine to what extent significant NATO/EUAF take account of fundamental components of SMS, such as Safety Policy, Safety Risk Management (SRM), Safety Assurance (SA) and Safety Promotion. Finally, this dissertation aims to close with the proposal of a common "Flight Safety in Combat Training" pilot's error framework for EU Air Forces, exemplified by "Deem the Métis" model.

Motivation

All humans make errors as an inevitable consequence of being human (Adams, 2006; Helmreich & Merritt, 1998). At the end of the twenty century, sophistication and reliability of fighter aircraft capabilities were improved considerably and increasingly challenged the abilities of pilots. Consequently, aircrew error began to play a progressively larger role in aviation accidents, as aircraft became more sophisticated and reliable (Shappell & Wiegmann 1996). The role of human error in aviation accidents is well established with previous studies reporting that between 70% and 80% of aviation accidents result from some type of human error (Lourens, 1989; Shappell et al, 2004). Moreover, most of these rates of accidents occurred not only in poorly or insignificant civil and military aviation organizations, but also in prestigious, war experienced and combat ready Air Forces, such as many of the remarkable NATO/EUAF.

Only during 2000-2010, the Hellenic Air Force (HAF), just one of the prominent Air Forces, counted fatal losses of 35 pilots and 60 aircrafts, so many as two of its fighter squadrons. In fact, most of these Category "A" aviation mishaps (>90%), safety occurrences and incidents have not occurred due to faulty control equipment or due to bird strikes, but rather to human error, rarely including mistakes made by air traffic controllers and aviation maintenance personnel. As a result, the greatest potential for reducing aviation accidents lies in understanding the human contribution to accidents (Wiegmann & Shappell, 2001). When the number and consequences of errors are reduced, safety is enhanced (Adams, 2006; Helmreich & Merritt, 1998). However, human performance doesn't take place in a vacuum; it always takes place in an environment engendered and maintained by management, government, and frontline personnel (Lauber, 1995), and flight operations occur within the context of three cultures – the national culture surrounding the organisation, the professional culture of aviators, and the company's organisational culture (Helmreich, R.L. 1998).

Therefore, nowadays supervisors (at all levels) acknowledge that errors are often based on organisational failings (RAF Bulleting, 2009). Generally speaking, the most elusive of latent failures revolve around issues related to resource management, organisational climate, and operational processes (Shappell, S.A, and Wiegmann, D.A., 2000). Indeed, all professional pilots in both the military and commercial aviation industries operate within an organization or company that regulates their time and performance in the cockpit. These organisations are also responsible for instituting appropriate procedures that ensure safe operations of the aircraft (Shappell and Wiegmann 2000).

Furthermore, Reason (1990) traced the causal chain of events back to the supervisory chain of command. As such, he identified four categories of unsafe supervision: inadequate supervision, planning of inappropriate operations, failure to correct a known problem, and supervisory violations. Fallible decisions of upper-level management directly affect supervisory practices, as well as the conditions and actions of operators. Unfortunately, these organisational errors often go unnoticed by Aviation Safety professionals, due in large part to the lack of a clear framework from which to investigate them. Therefore, from the organisational perspective, aircrew errors and subsequent accidents are believed to occur when high rank managers and supervisors fail to set up basic conditions within the organisation that promote flight safety (Reason 1990).

Last, but not least, many Air Forces are influenced by CSDP and NATO security policies, guidelines and directives, share common interests and contribute to the field missions and military capabilities concept of these organisations. Since interoperability is one of the main challenges which are unmoving in debate among several EU and NATO members' countries, Flight Safety in Combat Training may be one of the key elements that should be addressed.

Literature Review

The need to address the psychological or 'human' side of aviation safety sparked the emergence of several human error frameworks, such as the Human Factors Analysis and Classification System (HFACS). HFACS originally developed and tested within the U.S. military as a tool for investigating and analyzing human causes of aviation accidents (Wiegmann & Shappell, 2001). Drawing upon Reason's (1990) concept of latent and active failures, HFACS describes four levels of failure: 1) Unsafe Acts, 2) Preconditions for Unsafe Acts, 3) Unsafe Supervision, and 4) Organisational Influences (Shappell, S.A, and Wiegmann, D.A.,2000).

Although, recent investigations based on HFACS usually establish what and how injuries occur, it is often more problematic to identify why the injuries occurred, why the aircrews failed to escape and/or why they did not survive (M.E. Lewis, 2009). Furthermore, there is still a little empirical work that formally describes numerically the relationship between the levels and components in the model, such as the organisational structures, psychological pre-cursors of errors and actual errors (Wen-Chin Li & Don Harris, 2006).

In addition, a core civil aviation safety agency (i.e. ICAO) have launched through productive cooperation, coordination and exchange of ideas and data, the requirements for the implementation of effective Safety Management Systems (SMS), Fatigue Risk Management Systems (FRMS), State Safety Programmes (SSP) and Aviation Incident Reporting Systems (AIRS) by providing since 2008 to National Authorities all the necessary tools for the related training courses. On the other hand, prestigious NATO/EUAF have proposed and established over the years numerous other Safety Programmes, Safety Cases and Operational Risk Management (ORM) models for developing flight safety in combat training, defining and aligning competitive advantage.

Safety Programme Vs SMS: An Air Force Safety Programme is just different from a Safety Management System (SMS). An SMS is primary proactive and predictive. It is one method of requiring certificate holders to carry out their own safety risk and quality management. It considers hazards and risks that impact the whole organization, as well as risk controls (ICAO SMM, 2009). On the contrary, a flight Safety Programme is primary reactive and typically focuses on only one part of the system – the Air Operations (Safety Management International Collaboration Group – SM ICG, 2009).

Safety Case: UK MoD and Royal Air Force (RAF) officially published in 2002, the development of a Safety Case (i.e. JSP318B) that could provide a compelling, comprehensible and valid case that a system is safe for a given application in a given environment. However, on 28 October 2009, NIMROD accident report came to reveal organisational and safety culture shortfalls, leadership failures, an ineffective and wasteful Safety Case and a non "fit for purpose" Military Airworthiness System as the major causes for the loss of RAF Nimrod XV230 in Afghanistan on 2 September 2006 (Charles Haddon - Cave QC Report,2009).

ORM Vs SRM: Air Force's flight operations perform in a rapidly changing environment. Any changes to the situation (i.e. operations environment, needs for the unit) require a model that could immediate re-evaluate all possible risk level changes per step one. To this sense, the adopted by NATO/EUAF Operational Risk Management (ORM) model is neither dynamic nor responsive to abrupt changes. On the other hand, Safety Risk Management (SRM) is an iterative system with an internal continual cyclic process (ICAO SMM, 2009) and easily adjustable to any changes. Moreover, Cost Benefit Analysis - a key parameter that ORM model simply ignores - is at the heart of SRM and encompasses both the direct (i.e. physical damage, injuries) and the in-direct costs (i.e. damage to the reputation of the organization, loss of staff productivity) of the system.

On the whole, it is difficult to get an overall idea of how to classify and value all these flight safety management systems, tools, models and programmes. Undoubtedly, NATO/EUAF formally gives the impression of pursuing a goal to maximize their military aviation safety. However, it seems so far that each Air Force in that field isolated and independently, follows a different path in order to achieve an apparently common goal (emphasis added).

Research - Methodology

The requirement is a core, more comprehensive military pilot's error framework around which a new safety policy can be promoted, a new safety culture can be adopted, new lessons from civil aviation can be learned, new investigative methods can be designed and existing accident databases can be restructured. Nevertheless, the key research question is whether a common driven model or just a further quality improvement on existing national safety programmes will be more beneficial to EU Air Forces and adequate to promote flight safety in combat training among them. As a result, a number of steps will be developed to break down the task, as shown in fig.1.

To begin with, seven prestigious NATO/EU Air Forces, i.e. Royal Air Force (RAF), French Air Force (FAF), Hellenic Air Force (HAF), Royal Netherlands Air Force (RNLAF), Italian Air Force (IAF), Spanish Air Force (EdA) and German-Luftwaffe/ Air Force (GAF) will be initially compared. Based on the fundamentals prerequisites for the development of an SMS, a separate System Description for each Air Force (AF) will set off the project. The thesis initially plans to provide a better understanding of the environment and the existent safety culture in which each AF operates, rooted from personal working experience; extensive literature review; relevant and official statistical data; investigations of major accidents and Subject Matter Experts (SME's) reports; Pilot's Management and Safety survey's; questionnaires such as Safety Attitudes Questionnaire (Sexton et al., 2000; Thomas et al., 2003); Flight Management Attitudes Questionnaire (Helmreich et al, 1993); research on Safety Departments; Aviation Safety Industries/Organisations (i.e ICAO, EASA, FAA) and pertinent institutions.

Besides, this study will identify for every of the abovementioned Air Forces which of the components and elements of an SMS are currently in place and which components and elements must be added or modified to meet the SMS requirements (Gap Analysis). In addition, the results will be compared with the national and international requirements for establishing an SMS. An SMS implementation plan will be projected by using qualitative and quantitative research methods and the model Gantt chart. This plan will also focus on findings based on errors at the operational level as well as organisational inadequacies at both the immediately adjacent level and higher levels in the organization. At the end, the projected SMS plans will illustrate how NATO/EUAF can implement their own SMS on the basis of lessons learned from civil aviation, national requirements, international

Standard and Recommended Practices (SARP's), the findings of the System Description and the results of the Gap Analysis.

However, where really is the safety process level of a specific Air Force today? Which level of improvement is looking for and which level is possible? Therefore, a concurrent methodology, exemplified by "Deem the Métis" model in fig.2, comes to propose as well a quality improvement method for the reduction of safety process variability and other organisational issues that have an impact on human performance, during a hypothetic ICAO SMS implementation within Air Force organisations.

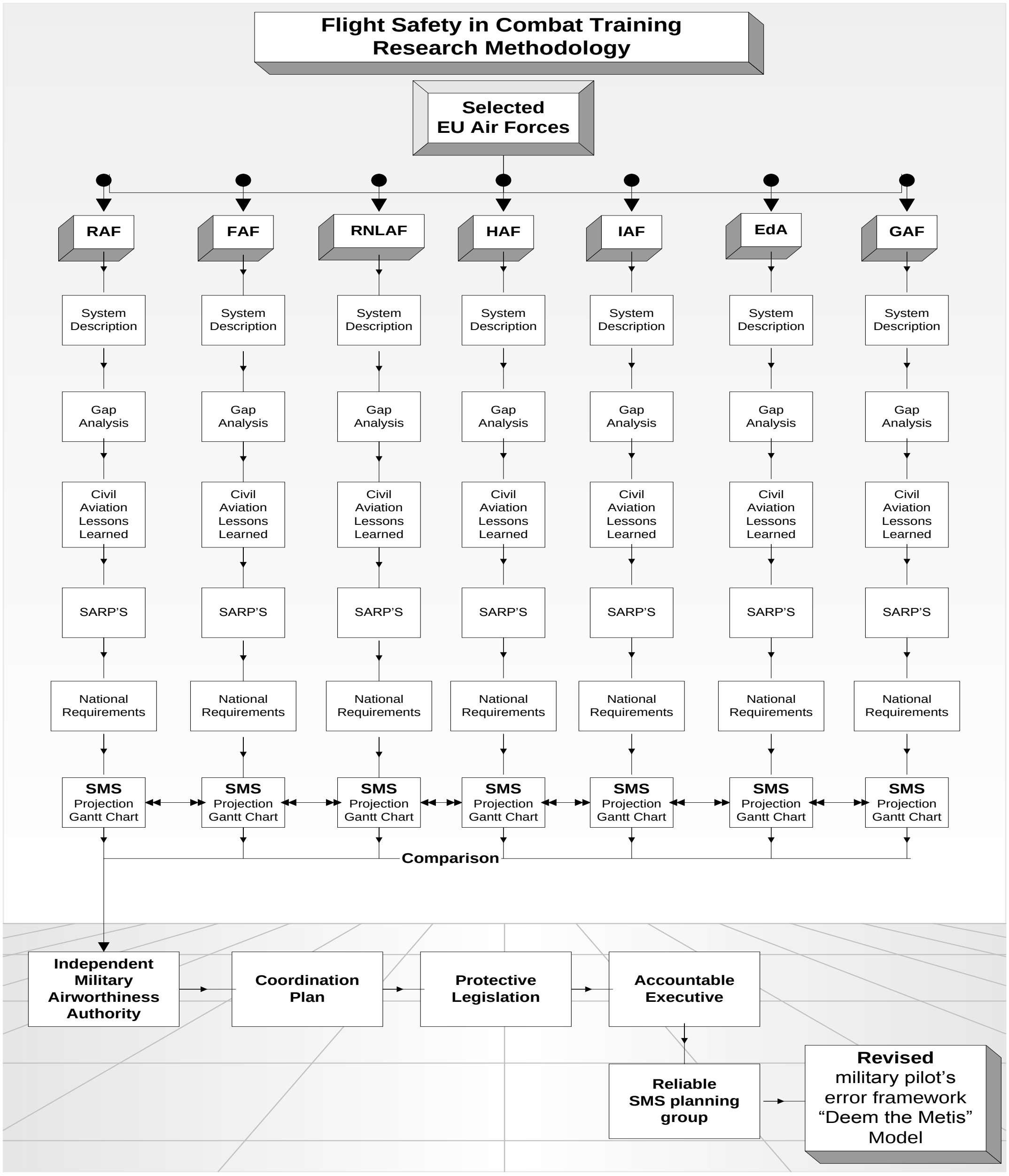

Figure 1: Research Methodology

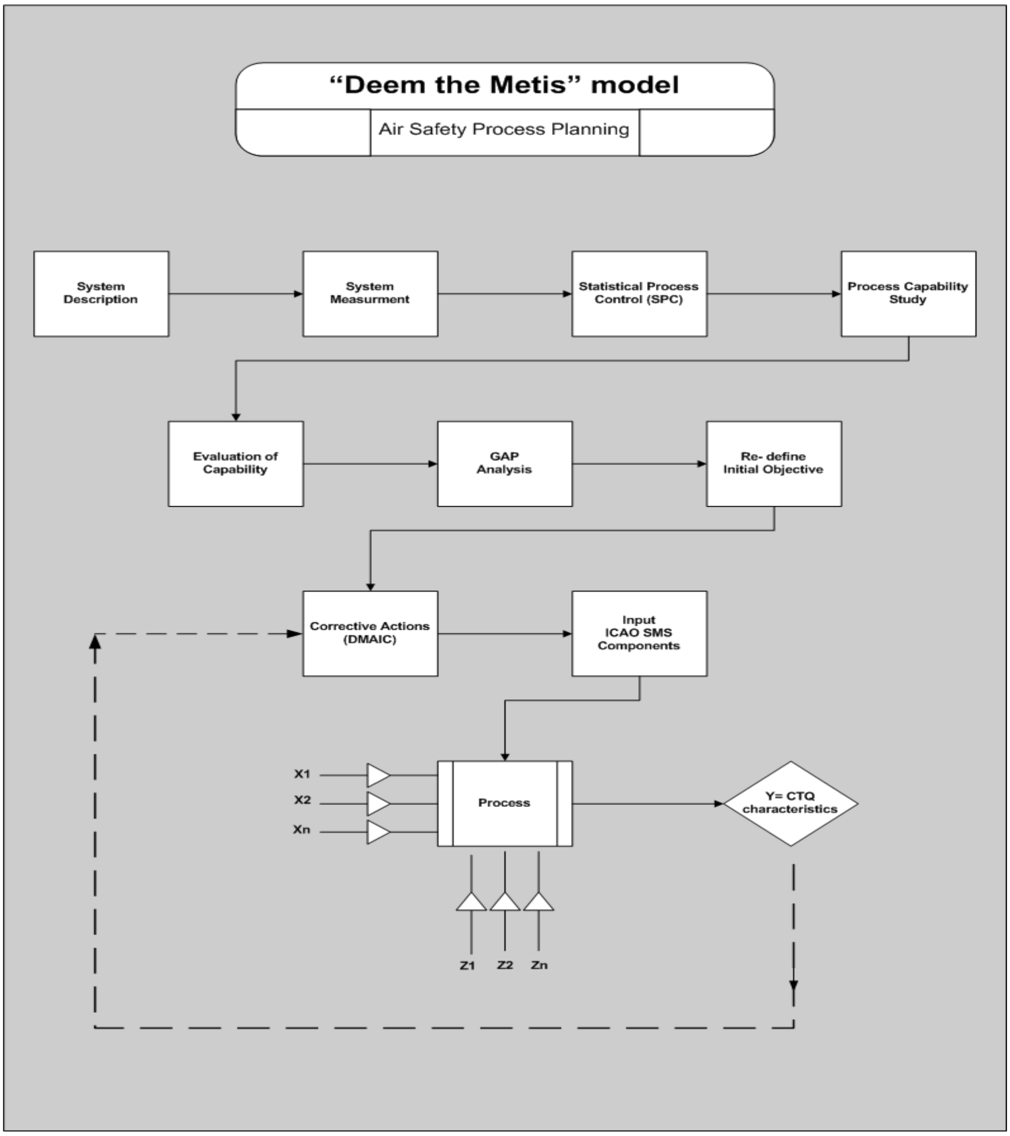

Fig. 2: 'Deem the Métis' model

Constrains

Without a doubt, this project is subject to a number of constrains. In an effort to surpass potential complexities, it will be beneficial to consider the following suggestions, prior to promulgation of a common NATO/EUAF Safety Management System rule.

(a) Formation of an independent National or EU-driven Military Airworthiness Authority (MAWA).
(b) Coordination Plan that MAWA should develop and give to the people in key MoD's positions the authority to set priorities for a revised pilot's error framework for NATO/EUAF
(c) Regulation for protecting SMS safety information and proprietary data against disclosure and inappropriate use.
(d) Assigned Accountable Executive who will be final responsible for the effective and efficient performance of the military organisation's
(e) Reliable planning group within each NATO/EUAF organization responsible for implementing the SMS framework.

Instead of Epilogue

This thesis aims to defend a proposal in the critical domain of aviation safety, to fill gaps in existing research, to cross departmental boundaries and to extend understanding in a particular topic, such as Flight Safety in Combat Training. So far, NATO/EUAF through various Flight Safety Programmes isolated and independently, follow a different path in order to achieve an apparently common goal. Therefore, it is important to provide an in depth scientific multi-national research, in order to further improve flight safety and safety culture in military aviation organisations. The outcome will produce and document meaningful recommendations for military operators and contribute to a contemporary approach for addressing military pilot's continual errors in the cockpit.

At the end, will NATO/EUAF achieve an acceptable quality sigma level of safety by adopting SMS? That's really not the question. The question is: "How much are existent flight safety process variations and defects costing them?"

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Environmental security and trans-boundary water management. Political and economic dimensions of river Evros "mis-management".

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There is a long and intense discourse in both the academic community and the policy making practice on whether the environment is a security issue. This paper will adopt the position that there is a strong connection of environmental threats with security, in its wider concept. In particular, the management of transboundary rivers has always been a source of tension and a sensitive issue of negotiation between states. This debate on the probabilities of conflict and cooperation in transboundary river basins has been expressed with various ways and within a multiplicity of levels from local societies to central authorities and from academic discussion to decision making. In the centre of this debate, playing the role of accelerating factor, stands the lack of a central international Authority/ Organisation charged with the power to set binding rules for national states. This lack of a strong international institution should be viewed along with the states interest for security via the pledge of sovereignty rights. Sovereignty issues can take various forms, some of which could trigger a potential water conflict. Indeed, the variety of causes for a potential water conflict, which spring from the sovereignty, debate can extend from water related development projects to water quality issues. In the case of Evros-Meric-Maritza river there is a lot of concern, however not followed with sufficient enough initiatives concerning its triangular management. Moreover, it is common every year to observe extended flood incidents in the river's delta both in the Greek and Turkish side with local farmers being frustrated from the lack of cooperation between the riparian states. For the Greek side, such a perpetuation, especially under the country's bad fiscal situation, could cause relatively extended economic stress to the local economy and the central government as well (due to the rural compensations) and possibly political turbulences with Bulgaria.

Is the Environment a Security Issue?

As scholars argue, *environmental challenges did not suddenly emerge with the end of the Cold War. The development of industrialized economies depends on natural resources* (Terriff et al, 1999: 17). Thus, important natural resources have always been at the forefront of inter and intra-state relationships. Nevertheless, there is a long history on how environment gained significant global attention. During the 60s, Rachel Carson brought the problem of *human-generated environmental degradation* in the discussion (IUCN). Subsequently, in the 70s the UN created the United Nation Environmental Programme (UNEP) setting the environment officially in the global political agenda. At the same time, the formation of Environmental NGOs, such as Greenpeace, brought environment closely to the civil society giving an even greater boost to the world's interest on it.

During the 80s the concept of sustainable development was established by the World Commission on Environment and Development (WCED). The outcome of this motion was the articulation of a comprehensive programme for environmental rescue – the UN Conference on Environment and Development's Agenda 21, in the 90s (IUCN).

At the same period, scholars tried to link environment with security. Dennis Pirages, for instance, claimed that 'ecopolitics' will be the new agenda for international relations (Pirages, 1978). Additionally, it was the first Palme Commission in the 1980s and the report on 'Common Security' that attempted to frame a linkage between security and environment (Independent Commission on Disarmament and Security Issues, 1982).

All this discussion signalled the one side of environmental security's perception. The heart of this side lies on the importance of human-caused environmental degradation which will be a major threat for the natural security of people, societies, states and the international system in general (Dabelko, 1996:2). Particularly, in the United Nations 1994 Human Security Report (UNDP, 1994:24-25), environmental threats considered to stem from the combination of local ecosystems degradation with global environmental change, both induced by the, impreceded in human history, ability of man to proliferate on the planet and induce global scale changes. Under this context, cooperation and not defensive preparation for conflict is the most effective way to deliver environmental security to individuals and societies (Conca and Dabelko, 2004: 286).

The other side of environmental security's definition has a more state centric perception. This perception focuses mainly on competition and conflict for crucial renewable natural resources (water, agricultural land, forests, fisheries etc) within the framework of state's security. Thus it fits well with the realist paradigm of security, introducing only minor modifications to the traditional geopolitical thinking (Terriff et al., 1999: 125).

In the 90s, the belief that environmental resources, and mostly renewable resources, could jeopardize security has emerged even more. It was argued that these resources are increasingly scarce in some regions, being at the same time essential to human development and thus competition over them can lead to incite conflict for their control (Terriff et al, 1999:119). This perception of environmental security has its own key figure, the work of Thomas Homer-Dixon and the Toronto School. The overall aim of this group was, as Homer-Dixon wrote, *to deviate from the conceptual* *polemic and to base research on firm empirical ground* (Ronnfeld, 1997:473-482). The concept of this School was that renewable wealth-producing resources will be reducing year by year especially in those parts of the world where there is lack of technological, societal and political knowhow to meet the new challenges; thus, environmental change may bring a state into conflict with others for control or access to an increasingly scarce resource, causing at the same time negative effects on its own societal and political cohesion. Homer-Dixon, characteristically argued that, *unequal distribution,* or as he called it-*structural scarcity, is a key factor in virtually every case of scarcity contributing to conflict* (Homer-Dixon, 1999:15).

However, conflict over renewable resources in the past has been rare and seldom could it be attributed to solely environmental causes. But in several cases disputes over, for example, limited water resources or even fisheries have created tension and might have contributed to conflicts in parallel to other possible causes (e.g. the Anglo-Islandic ‘Cod War’ in 1972-73 or Six-Day War of Israel) (Homer-Dixon, 1994, 2000; Mitchell, 1976; Naff and Matson, 1984).

In general, it is important to note that both these two perceptions of environmental security are complementary. So, any attempt to accept the one or the other seems tricky rather than right. Within this concept this paper will try to examine the issue of transboundary River Evros from the side of Greece, paying considerable attention to the contemporary managerial status of the river and the consequences the latter has on this particular geographical area of Greece.

Transboundary River Management.

Water is set as a key environmental resource for social security, economic growth and prosperity. Water is an essential element for every living being on earth. Almost 2/3 of the planet is covered with water. However, only the 2.7% is potable while most of it can be found in the form of ice in the poles and on the top of mountains. Moreover, 73% of fresh water goes to agricultural use because of increasing needs for production which follow the raise of earth’s population (Kiss et al, 1997: 290). Additionally, of crucial importance also is the fact that the distribution of water resources is anisomeric causing problems to areas of high population density.

Consequently, it can be claimed that fresh water is likely to stimulate future inter-state wars, being the most famous renewable resource cited as a possible source of acute conflict. More specifically, these potential conflicts can emerge in those particular cases where there are trans-boundary water management issues and particularly international Rivers. In fact, as Homer-Dixon argues, wars over river water between upstream and downstream countries can emerge under four circumstances:

- *The downstream country must be highly dependent on the water for its national well being*
- *The upstream country must be threatening to restrict substantially the river’s flow*
- *There must be a history of antagonism between the two countries*
- *The downstream countries must believe that they are military stronger than the upstream countries* (Homer-Dixon, 1999: 139).

A major accelerating factor for the negative prospective of conflicts around international river basins is the lack of a central international Authority/ Organisation charged with the power to set binding rules for national states. This lack of a strong international institution should be viewed along with the states interest for security via the pledge of sovereignty rights. Sovereignty issues can take various forms, some of which could trigger a potential water conflict (Mandel, 1992). Such concerns extend from water related development projects to water quality issues. For instance, the importance of water along with scarcity could lead one of the riparian states to implement a project that adversely impacts the others. Striking examples can be found in the Middle East, where, for many experts, water wars are more easily to be traced. As a typical case, the Six-Day War between Israel and its Arab neighbours is, as mentioned earlier, commonly analysed in the relevant discourse. The war finally ended with Israel having the control of half of the Yarmouk River after the ceasefire, compared to just 10 km before the war (Naff and Matson, 1984).

Nevertheless, a review of the international literature shows that cooperative agreements seem to prevail over the conflict situations. ‘Water wars’ of great scale are not the widespread case of transboundary water management. Yet, political conflicts of low escalation have often emerged in the past and most likely will continue in the future (Dinar, 2002).

Moreover, the international literature provides many examples on conflict resolution theories. For instance, the utilisation of problem-solving workshops as a negotiating technique over natural resources management disputes is very common. According to Beach et al. (2000) such techniques were involved in at least 160 cases of natural resources conflicts. Among them, in 132 cases the involved parties were willing to find a solution, while 78 per cent of the total cases examined were successful in producing an agreement. However, within this extensive list, only 10 per cent of the cases involved water resources, including water supply, water quality, flood protection and the thermal effects on water bodies of electricity generation plants.

Hayton (1993) tried to examine the status of the cooperative agreements for the development of water resources shared by two or more countries. The author concluded that such agreements may vary from simple data exchange to the implementation of major projects and the formal resolution of disputes. Nevertheless, he went further stating the ascertainment that while there is a growing distress regarding the management of shared water resources, this is not followed by an equivalent anxiety over the use and protection of these resources, underlying that way the exigency of an institutional engagement. The percentage of institutionalised cooperation can be boosted by the participation of third parties. In the relevant literature a large number of cases regarding this kind of engagement may be found. For instance, already since 1977, Fano (1977) has discussed the role of third parties in particular cases of water scarcity in developing countries. An international institution that could undertake such a role is undoubtedly the World Bank. Several of its in-house publications stress its role as a crucial contributor towards the solution of international water disputes (World Bank, 1993, 2004; Salman et al., 1998).

The Maritza-Evros-Meric River.

The Evros River is one of the major river systems located in the eastern Balkans, with a total length of 550 km and a total catchment area of 39,000 km² (including its tributaries). In fact, Evros is the second longest river in the Balkans after the Danube. About 66% belongs to Bulgaria, 28% to Turkey and 6% to Greece. Of extremely great ecological importance is the delta area (about 188 km^2) which is protected by the Ramsar convention on Wetlands that was signed in Iran in 1971.

Apart from the great ecological importance that the River has, its significance lies also in terms of economic development of the local communities in all three countries. To be more specific, for Bulgaria and Greece, the River serves as a water source for agricultural use. Particularly for Greece the land close to the delta is used for agriculture (about 150 km²), where cotton, medic, sugar beet, sunflower, tomatoes and asparagus are grown. Hunting and commercial fisheries are also part of River's usage. For the Turkish side, half of the area is used for irrigational and dry farming. The area also is one of the most developed parts of Turkey and there has been an important increase of industrial facilities during the 1990s due to the geographic location of the area: Very near to EU borders from one side and very close to the economic capital of Turkey from the other.[1]

A problematic River

It seems that despite the importance of the River, there are no common routes of collaboration between the three riparian states. Taking a quick look to previous bilateral or trilateral agreements, we can unveil the progress that took place (or lack of progress) concerning the collaboration on the River's management. To begin with, bilateral cooperation between Bulgaria and Greece can be traced back to 1964.[2] Both countries ratified the Helsinki Convention for protection and use of trans-boundary watercourses (1992; in GR forced since 1996) and the Espoo Convention. After the implementation of the Helsinki Convention, the two states created a joint monitoring system which included River Evros-Maritza. Another agreement was signed in 1971,[3] between Greece and Bulgaria concerning the formation of a joint committee for the cooperation in the field of electric energy and the use of cross-border river waters (Sofia, 1971). We have also many other protocols signed from both countries concerning cooperation, technical and scientific assistance on the management of trans-boundary Rivers. Nevertheless, only the agreement of 1964 has specific measures to be taken, mostly concerning flood protection. It refers to the series of reservoirs in Bulgaria and operates between local authorities as a precaution when the Bulgarian reservoir gates release excess water upstream while informing and warning at the same time Greek local authorities. Moreover, the duration of this agreement was set to 60 years and also included the obligation from the side of Bulgaria to

[1] Data collected from the International Network of Water-Environment Centres in the Balkans, www.inweb.gr

[2] Agreement on Cooperation between the People's Republic of Bulgaria and the Kingdom of Greece concerning the utilization of the waters of the rivers crossing the two countries, Signed 9/7/1964 in Athens. Legislative Decree 4393/1964, Official Gazette 193/A' 4-11-1964.

[3] Greek Bulgarian Committee for cooperation in the fields of electric energy and the utilization of the rivers of the waters crossing the two countries, Signed 12/9/1971 in Sofia.

release annually 186 mil. c.m irrigation water to Greece through the Ivaelogrand dam.[4]

In 1991 another initiative was taken leading to the Protocol of the Meeting of the Joint GR-BG Committee of Experts for the preparation of a common proposal to the EU for the joint monitoring and control of water quality and quantity of the trans-boundary rivers Maritsa/Evros, Mesta/Nestos and Struma/Strymonas. This actually led to the 2000-2006 EU-BG-GR agreement under the umbrella of the Interreg programmes which supported the installation of hydro-meteorological monitoring stations to deal with the floods. However, the success of this initiative is doubtful bearing in mind first the fact that the six stations located in the Greek side were never been fully operational, and second the floods of 2003, 2005, 2006 and of course the latest ones of February and April 2010 that caused severe economic damages to the Greek economy (Mylopoulos et al., 2008: 291).

Main hindrances for Evros management.

The complexity of the Maritza-Evros-Meric River is mainly due to politico-historical factors. Initially, looking carefully the River we will discover that almost 208 Km of the River lies as borderline between Greece and Turkey; Thus, both Evros and its tributary Ardas (shared by Greece and Bulgaria) are located in a military controlled area. This means that special permit must be requested from military authorities in order for scientific and other activities to be held. Of course, the bad historical relations between Turkey and Greece can only work as a deterrent factor for a possible future cooperation.

There also is another imperative differentiation among the riparian countries. Specifically, Bulgaria, the upstream country, is a new EU member under transition period and with a lot of institutional reforms on the way. Greece, the one of the two downstream countries, is an old member of EU with high dependence on upstream trans-boundary waters, while Turkey, the other downstream country, has opened negotiations for joining the European Union. This means that Turkey is not actually obliged to follow the Water Framework Direct of the EU (WFD 2000/60). At the same time there is a quite slow implementation of the Directive from the side of Greece and Bulgaria and definitely sluggish progress for cooperation between these two EU members which can be portrayed as unwillingness for cooperation especially from the side of the upstream country.

The River's importance for Bulgaria also is a major reason for the expansion of political tensions between the three riparian states. Bulgaria uses the River for electric power generation through three major hydroelectric dams with the dam of Ivaelogrand being the last and biggest one. In order to safeguard its energy needs, Bulgaria keeps the level of water in the dams at a high point, which, in periods of extended rainfalls, means the overflow is unavoidable and leads to extended floods in the Greek and Turkish part of the River.

[4] Data collected from the International Network of Water-Environment Centres in the Balkans, www.inweb.gr

A costly River for Greece.

The unwillingness or indifference of the riparian states, to collaborate efficiently creating a common plan for the management of the River, has been quite costly for Greece's economy. In a recent parliamentary discussion, the flood problems that affect the region around Evros River, were mentioned by the local member of the parliament Mrs. Rentari-Tente. She referred to the catastrophic consequences that these incidents have to the region. Every year thousands of acres of rural property are destroyed, villages and roads are devastated and the reaction is almost always the same, monitoring of the losses, paying compensations to the victims and repairing the dykes.[5]

According to recent data collected from the Region of Eastern Macedonia-Thrace, during 2010 the cost for the flood preventing works was €1.609.430,00. The previous years, the cost was for 2006 € 4.720.000,00 and for 2007 € 2.540.000,00 respectively. These amounts are going mainly for the restoration of old dykes and the construction of new ones. Important amounts were also spend as compensations of the 3.263 farmers of the Evros region for last year flood destructions of their agricultural production, estimated to € 7.140.306,64 approximately.[6] Nevertheless, there also are adjacent losses in terms of population density. Practically, the rural population is decreasing since the extensive flood incidents of the previous years caused significant economic losses for local farmers, leading to an increase of urbanization especially for younger people who do not see their future in agricultural production. This consequently participates negatively to the increasing deficit of the agricultural trade balance of our country.

Conclusion

In order for all these obstacles to be surpassed there must be a stronger political pillar which will enhance cooperation and will be responsible for creating an enabling environment. An institutional pillar is also needed to ensure the creation and implementation of legal agreements. The ultimate goal should be the establishment of an effective and functional River Basin Organization (RBO) which will safeguard a sustainable and just use of the River under a strong political and financial commitment and with clear legal status. Greece should also request the involvement of an international institution.

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[5] Parliamentary Discussion, 5/5/2011.

[6] Source: Ministry of Rural Development and Food. ELGA.

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