Global Aviation Information Network

The Other End of the Radio:

Identifying and Overcoming Common Pilot/Controller Misconceptions

Interim Report

Prepared By:

GAIN Working Group E:
Flight Ops/ATC Ops Safety Information Sharing
September 2004

This report is available online at www.gainweb.org

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Table of Contents

Acknowledgements

The co-chairs and members of the Flight Ops/ATC Ops Safety Information Sharing Working Group of Global Aviation Information Network (GAIN) would like to thank all of the individuals and organisations that made this report possible:

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Survey Respondents

Working Group E would also like to thank the air traffic controllers and pilots who so graciously participated in the group's surveys.

Invitation to Participate

The GAIN Flight Ops/ATC Ops Safety Information Sharing Working Group (WG E) is an open-membership group consisting of individuals who believe that encouraging greater understanding and collaboration between pilots and air traffic controllers will benefit flight safety and efficiency. WG E holds meetings approximately four times per year, and holds regular teleconferences about once per month. Interested persons can participate by email, by calling for teleconferences, and/or attending in-person meetings.

If you would like to learn more about participation in WG E, please contact the GAIN Program Office at +1 (202) 267-9740 or visit www.gainweb.org.

1.0 Introduction

1.1 Purpose of Report

This report was developed by the Global Aviation Information Network (GAIN) Working Group E (Flight Ops/ATC Ops Safety Information Sharing Working Group) and is intended to highlight the safety and operational benefits of increased pilot/controller collaboration and understanding. In June 2003, GAIN Working Group E released a report, *"Pilot/Controller Collaboration Initiatives: Enhancing Safety and Efficiency,"* which documents 27 successful collaboration initiatives throughout the world, both at the local level and at the national and international level. This interim report addresses ways to incorporate this collaboration in the educational and training phases of controllers' and pilots' careers. It also discusses the systematizing of pilot/controller collaboration in an operational setting. The objectives of this report are:

- Illustrate areas where pilots and controllers believe that their counterparts could benefit by learning about each others' jobs.
- Analyze differences in pilot and controller education and training, and identify "cross-educational" topics that should be added.
- Provide off-the-shelf syllabi to educators and trainers to increase knowledge of ATC and pilot communities.
- Provide approaches for systematizing pilot/controller collaboration.

1.2 GAIN Overview

GAIN is an industry and government initiative to promote and facilitate the voluntary collection and sharing of safety information by and among users in the international aviation community to improve safety. GAIN was first proposed by the Federal Aviation Administration (FAA) in 1996, but has now evolved into an international industry-wide endeavor that involves the participation of professionals from airlines, air traffic service providers, employee groups, manufacturers, major equipment suppliers and vendors, and other aviation organizations. To date, six world conferences have been held to promote the GAIN concept and share products with the aviation community to improve safety. Aviation safety professionals from over 50 countries have participated in GAIN.

The GAIN organization consists of an industry-led Steering Committee, three working groups, a Program Office, and a Government Support Team. The GAIN Steering Committee is composed of industry stakeholders that set high-level GAIN policy, issue charters to direct the working groups, and guide the program office. The Government Support Team consists of representatives from government organizations that work together to promote and facilitate GAIN in their respective countries. The working groups are interdisciplinary industry and government teams that work GAIN tasks within the action plans established by the Steering Committee. The current GAIN working groups are:

- Working Group B--Analytical Methods and Tools,
- Working Group C--Global Information Sharing Systems, and
- Working Group E--Flt Ops/ATC Ops Safety Information Sharing.

The Program Office provides technical and administrative support to the Steering Committee, working groups, and Government Support Team.

1.3 Working Group (WG E): Flight Ops/ATC Ops Safety Information Sharing

In January 2002, the GAIN steering committee formed a new working group to foster increased collaboration on safety and operational information exchange between flight operations and air traffic control operations. The basis for forming this new working group, designated "Working Group E: Flight Ops/ATC Ops Safety Information Sharing," was a very successful workshop at the Fifth GAIN World Conference in Miami in December 2001, which highlighted the need for improved interaction between air traffic controllers and pilots on safety issues.

WG E released its report, "Pilot/Controller Collaboration Initiatives: Enhancing Safety and Efficiency" at the Sixth GAIN World Conference in Rome, Italy. This document includes an overview of how pilots and controllers are collaborating to improve safety and operations, and 27 examples of successful initiatives taking place at facilities around the world.

In August 2003, Working Group E developed its 2003-2004 Action Plan, which contains three main focus areas:

Focus Area 1:	Promote the development and implementation of a "Just Culture" environment within the Flight Ops and ATC Ops communities
Focus Area 2:	Identify Flight Ops/ATC Ops collaboration initiatives that improve safety and efficiency.
Focus Area 3:	Increase awareness of the benefits of pilot/controller collaboration and promote such collaboration in training and education programs.

To address Focus Area 1, WG E has developed a report to be released at the Seventh GAIN World Conference, entitled "A Roadmap to a Just Culture: Enhancing the Safety Environment." A prerequisite to the collection and sharing of safety information is the culture of the organization itself. WG E is promoting the "just culture" concept, which describes an atmosphere of trust in which people are encouraged, even rewarded, for providing essential safety-related information – but in which they are also clear about where the line must be drawn between acceptable and unacceptable behaviour. The policy of just culture is designed to encourage compliance with the appropriate regulations and procedures, foster safe operating practices, and promote the development of internal evaluation programs. This report is available for free download at www.gainweb.org.

Focus Area 2 is a continuation of WG E efforts that culminated in the release of the "Pilot/Controller Collaboration Initiatives: Enhancing Safety and Efficiency" report, to document additional initiatives for future updates to that publication, and is also available for free download at www.gainweb.org.

WG E prepared this document specifically to address Focus Area 3. During the research and documentation of the "Pilot/Controller Collaboration Initiatives" report, WG E members discovered that one of the underlying reasons for these initiatives was a general lack of awareness between pilots and

controllers about the others' work environment. One of the primary reasons that this situation exists is that the initial educational and training processes currently in place for controllers and pilots often do not provide much information about what happens on the "other end of the radio." Even less attention is given to this topic as part of the recurrent training process.

1.4 Content of Report

This report documents results from surveys of pilots and controllers, and cites relevant studies to address misconceptions between these groups. The report is divided into four main sections:

- **1.0 Introduction:** Describes the purpose and layout of the report, presents an overview of GAIN and Working Group E, and discusses planned report updates.
- **2.0 Diagnosis:** Provides a summary of general categories of pilot/controller misconceptions, survey results, and a comparison of current education and training processes for pilots and controllers.
- **3.0 Treatment:** Contains suggestions on topics related to pilot/controller collaboration as well as sample course material on ATC and flight training for inclusion in pilot and controller training and education programs. This section also describes a hierarchy of collaboration methods and some example collaboration initiatives at the operational level.
- **4.0 "Where Do We Go From Here?":** Discusses the need for systematic and consistent pilot/controller collaboration, and provides some preliminary ideas for developing and implementing pilot/controller collaboration education, training, and monitoring programs.

In addition three appendices contain sample course material used in two current pilot/controller collaboration initiatives, survey forms used by Working Group E to survey pilots and controllers, and a form for readers to provide feedback on the report.

1.5 Report Updates

Working Group E recognizes that more input is needed to expand the scope of understanding on pilot/controller collaboration. The group hopes that future editions of this report will expand on the information contained herein, and looks forward to collaborating with others in this effort. Most of all, Working Group E would like to increase the dialogue among pilots, controllers, regulators, academics, training institutions, and others for the benefit of flight safety and improved communications.

Working Group E hopes you find this report interesting and useful in your profession, and welcome feedback. Feel free to use the feedback form included in Appendix C. Please direct correspondence to:

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2.0 Diagnosis: Common Pilot/Controller Misconceptions

2.1 Pilot/Controller Misconceptions and Safety

Everyday, pilots and air traffic controllers interact on the radio to guide thousands of aircraft to safe landings. They are among aviation's best trained professionals and use advanced technology and standard phraseology to communicate with each other. Each of these disciplines is particularly specialized – the pilot is the expert in flying the aircraft safely and efficiently; the controller is the expert in separating aircraft and sequencing them in a safe, orderly, and expeditious manner. However, even at the highest levels of proficiency in the cockpit and in the ATC facility, there are often misconceptions about what goes on at the other end of the radio.

While it may be true that controllers know more about flying aircraft than most anyone except pilots, and that pilots may understand air traffic control better than anyone other than controllers, the complexity and ever-evolving nature of each profession makes developing and maintaining a deeper understanding of the other professional very difficult. Both airlines and air traffic service providers must prioritize the many demands on pilot and controller training time, with priorities being regulated topics related to their primary operational responsibilities, and company-required training material. There are always existing procedures to be reviewed, procedures and systems to be learned, technology improvements to be trained, and regulations to be interpreted. The ever-increasing congestion and complexity in the aviation system mean that staying current with one's own operational environment is a challenge in and of itself.

After putting safety first, pilots and controllers have different responsibilities and operational priorities. For example, during an approach procedure, a pilot will be primarily concerned with a stabilized approach and altitude and speed requirements, while a controller will be concentrating on spacing and sequencing standards. During a pilot's initial flight training, he or she may have been taught to "aviate, navigate, communicate" – in that order – while a controller receives substantially more priority on communication – the primary means of exercising his or her job responsibilities.

Thus, it is no surprise that pilots and controllers often hold incorrect or incomplete perceptions of the other's workplace environment, motivations, responsibilities, or expectations. But how important is it that pilots and controllers gain a better understanding of the other's environment?

- An analysis of 1184 Airport Surface Movement Event Transgression (ASMET) incidents in the Aviation Safety Reporting System (ASRS) revealed that 254 (21 percent) involved pilots misunderstanding taxi clearances; 235 (20 percent) involved pilot confusion about ATC instructions, and 110 (9 percent) involved readback/hearback errors.
- One of the major conclusions of the Flight Safety Foundation (FSF) International Approach and Landing Accident Reduction (ALAR) Task Force, based on an analysis of worldwide accidents, was "Improving communication and mutual understanding between air traffic control services and flight crews of each other's operational environments will improve approach and landing safety."

- The International Air Transport Association writes on its website (www.iata.org/whatwedo/infrastructure) that "Accident and incident analyses show the complex interrelationship between causal factors attributed to air traffic services and flight operations. Accident prevention can only benefit from effective direct interaction and communication between pilots and ATC outside the cockpit, radar room and control tower."
- The EUROCONTROL Guidelines for Controller Training in the Handling of Unusual/Emergency Situations notes that "an educational process needed to be undertaken to ensure that both pilot and controller groups were aware of the many misunderstandings which obviously existed within each group as to the needs of the other," and suggested that "joint training sessions using airline simulators might also be of benefit for the controller and the pilot."

Clearly, overcoming misconceptions is an important aspect of further reducing risk and increasing safety.

2.2 General Categories of Pilot/Controller Misconceptions

Before developing strategies to address these misconceptions, a better understanding of commonly-held misconceptions needs to be attained. As a starting point, GAIN Working Group E grouped commonly-reported misconceptions into seven categories in its 2003 report, "Pilot/Controller Collaboration Initiatives: Enhancing Safety and Efficiency":

Aircraft Performance Characteristics

> One common issue that many initiatives in the WG report address is the result of the varying aircraft performance characteristics when controllers use one of their primary tools to maintain longitudinal (in-trail) separation: speed control. Because controllers communicate with and direct a very broad range of aircraft types from the global air fleet, they may not be aware of performance limitations of every type of aircraft encountered. Today's aircraft types include a wide range of large and small turbojets, piston-powered general aviation aircraft, military and cargo aircraft, modified and experimental aircraft, and turboprops that, in some cases, have markedly different performance characteristics. These aircraft use widely different flight deck procedures and have widely different levels of cockpit automation, all of which may impact the aircrews' ability to comply with a given ATC instruction. There are also differences in manufacturer-recommended speeds to be flown and in equipment operating speed limitations that must be observed. All of these differences may be relatively invisible to controllers and therefore make it difficult for controllers to issue appropriate instructions at appropriate times to ensure that a constant interval is maintained during the final approach queue.

Approach Procedures

> Another issue that is often the subject of discussion in pilot/controller meetings is the result of efforts to minimize aircraft noise and fuel consumption, which tends to keep aircraft higher on arrival profiles. The newer generation aircraft, particularly the turbojet fleet, are very efficient, or "clean." Their ability to "go down and slow down" simultaneously is significantly reduced, so getting down on profile may require significant advance planning. A controller may issue a

speed reduction and a descent clearance at the same time, and naturally expects compliance. If the aircrew cannot or does not comply, inefficiencies or even hazards may be introduced into the system. Unless action is taken to help controllers to understand why pilots are slow to comply with clearances, such problems will invariably continue and may worsen.

Cockpit Automation

High levels of cockpit automation in modern aircraft may also contribute to these types of problems. At busy airports with complex arrangements of runways and therefore arrival and departure flows, controllers must perform a delicate balancing act to ensure the flight paths of aircraft going to and from all runways are safely and efficiently integrated. Changes anywhere in that system, especially unforeseen changes, can change the controllers' plans and requirements dramatically, leading to the need for changes in aircraft flight paths. If the aircrew must effectively "reprogram" onboard systems to accommodate such changes, a finite amount of time may be required before the aircrew can comply. If the controller has never been made aware of this time requirement, he/she may expect a reaction far sooner than it can be made to happen, resulting in frustration, replanning and inefficiency.

Introductions of New Aircraft

Similarly, the introduction of a new type of aircraft to an airport may precipitate the need for different procedures for both controllers and pilots. For example, at an airport that has been served exclusively by turboprop aircraft for many years, controllers will have become accustomed to the performance characteristics of that aircraft and will have, either consciously or not, incorporated those characteristics into their own decision-making and planning processes. If a new airline enters that market with a turbojet aircraft, existing practices may no longer be appropriate. An even more difficult situation would be if the "traditional" carrier begins to upgrade its fleet. A given flight may be one type aircraft one day and an entirely different type the next. Unless there is robust dialogue and established pattern of continuous controller-pilot interaction, incompatibilities between the "old" practice and the "new" airplane may go unnoticed until operations are affected. Absent any pre-coordination, controllers will logically expect the same performance from the aircrew today as they saw yesterday, and pilots may well assume that the controller's instructions will be appropriate for the new flight deck. Neither may be the case.

Changes to Equipment/ATC Procedures

There are sometimes difficulties in accommodating certain aircraft with exemptions for certain categories of equipage in the same airspace. For example, there are some aircraft that cannot use RVSM spacing, there are other aircraft that cannot fly RNAV routes, there are some aircraft that are not equipped with radios with 8.25 kHz spacing, and there are some aircraft that are limited to certain airspeeds. Add to these challenges differences in radio transmission in various regions around the world, the use of languages other than English for radio transmissions, and the emerging use of non-verbal communications (e.g. data link) in operations, and the benefits of increased collaboration become apparent.

Landing & Runway Exiting Procedures

There are times when increased interaction among pilots and controllers could positively affect mutual understanding of landing roll speed reduction procedures as well as runway exiting procedures. In this example, a controller may anticipate that an aircraft will exit at a particular turnoff, resulting in a runway clear for departures, and plan his or her departure sequence accordingly. However, the aircraft may roll by the expected taxiway, or may not be able to accept an exiting instruction due to the aircraft's speed or turn capability. Turn and braking capability can vary considerably based on aircraft type, company policy, weather, landing weight, or even pilot preference. All these differences may impact runway exiting. When an aircraft doesn't exit the runway where the controller expects, the resulting situation can cause a go-around, an unexpected immediate takeoff clearance, or require a departure to taxi off the runway. For example, pilots are sometimes unaware of controllers' requirements generated by airspace sectorization, configurations of approach paths relative to departures or other approaches, etc. What appear to be optimal climb or descent profiles to the pilot may present controllers with difficult or dangerous situations that should be avoided. Such lack of mutual understanding can result in unnecessary radio transmissions or delayed compliance with instructions, resulting in confusion and reduced effectiveness of ATC procedures. These all have potential safety implications as well as impacting operational efficiency.

Training

In addition to the vast amount of technical training in subjects unique to their own job responsibilities and equipment, pilots and controllers do share many subjects in their initial and current training. However, the depth and regularity of this instruction differs. For example, pilots receive in-depth training and have more experience in subjects such as stabilized approach requirements, crew approach briefing requirements and the ramifications of last minute runway assignments, rates of turn vs. bank angle and airspeed, true airspeed vs. indicated airspeed, weather related issues affecting aircraft performance, etc. Likewise, controllers receive more in-depth training and have more experience in other subjects such as airspace limitations, spacing and separation requirements, problems caused by making last minute clearance requests, coordination and limitations between sectors, dynamics associated with controlling multiple aircraft types, etc. While both pilots and controllers receive phraseology training, it is done at different stages of each operator's training cycle and to a different degree. Many of the initiatives in this report were developed to address communication concerns involving phraseology.

2.3 A Controller's Perspective: "What I Want Pilots to Know About ATC"

"Tower…say again?"

One of the most important bits of information for pilots to know about ATC is that it is *always* preferable from a controller's perspective to ask for clarification of a radio transmission that the pilot may not have fully understood. Comment from pilots – particularly low-time pilots –received during the survey portion of this report included "I try not to bother the controller with questions," "I was

embarrassed to say that I didn't understand the instruction," and "When a controller is busy, they can be 'short' or even rude to pilots." If a pilot isn't exactly sure of what he thought he heard the controller say, by all means he or she should ask the controller to "say again" or ask for clarification. The controller may indeed be very busy, and may indeed need to make quick transmissions, but repeating or clarifying a control instruction is always preferable to a pilot misunderstanding a transmission and taking the wrong heading or climbing/descending to an incorrect altitude. While it doesn't happen often, these actions can cause serious problems in congested airspace and can be avoided through improved communication.

Another area often overlooked by pilots is the role of airspace "ownership" and inter-facility coordination required of controllers. It is important for pilots to be aware that all airspace is designed differently and controllers only control a small portion of the airspace that a pilot's flight will traverse. At times, a pilot may become frustrated when he makes a request to climb higher or get lower or to make a turn to avoid the weather and is told to standby. In most cases pilots are told to standby while the controller coordinates with another facility controller or the control agency that owns the adjacent airspace. Often the airspace the controllers are working with have a number of restrictions and in order to get a pilot's request approved the controller must coordinate with another controller or an adjacent facility. So if a controller does not respond immediately to a request, the pilot should remember that getting the request approved may mean the controller is on the landline making a call to eliminate any conflicts first.

Aircraft characteristics can be another area that creates problems. For example, there are many airplanes in the inventory and at times controllers will be controlling an airplane of which the characteristics are not totally familiar. If the controller gives a control instruction that the pilot cannot accept, the pilot is well advised to inform the controller. For example, if the pilot were on final and the controller thought at his current speed the pilot might loose separation, the controller might issue an air speed reduction. Or, if the controller wanted to sequence the pilot into the traffic pattern, he might issue an airspeed reduction to get the necessary spacing. These techniques are used only to expedite the safe and orderly flow of traffic. If the pilot is given a control instruction that he feels is inappropriate for his aircraft, he should provide the controller with that information so another option can be given. The controller and pilot should always work together to keep the air traffic system and flying public as safe as possible.

Every controller comes to work with the intent to keep the flying public safe and to make the pilot's job as easy as possible and free of confusing instructions. At times however, there will be misunderstandings with phraseology or even a transmission that was missed. While miscommunication, deviations, and errors occasionally happen, the air traffic control system is nonetheless the safest it has ever been. We can continue to make improvements if we, the controllers and pilots, continue to talk about things that did not seem quite right. Visits to air traffic facilities by pilots to obtain a better understanding of the airspace system in which they fly will help pilots and controllers each better understand the world in which they operate. The first step in gaining a better understanding between pilots and controllers is – and always has been - communication.

2.4 A Pilot's Perspective: "What I Want Controllers to Know About Flying"

"Cleared for the visual approach, maintain not less that 190 knots until 5 DME, keep it in tight, you are number one"

This is an example of a clearance by a controller that could unknowingly put a flight crew into a difficult situation. In an attempt to comply, the crew may be forced into an unstable approach situation if they were not expecting this clearance. Today's transport category airplanes are highly automated and extremely efficient. A certain degree of planning is required to ensure that the aircraft remains on profile, and achieves a stabilized approach. Most operators require that the approach be stabilized no later than 1000' in IMC conditions, and 500' in visual conditions, or a go-around will be necessary. An unexpected vector to final will in most cases put the aircraft well above profile. The flight crew will quickly assess the situation while trying to comply with the clearance. In this situation, the frequency is congested, and communication may be difficult. If this results in an unstable approach, the highly disciplined crew will go-around. Others may elect to continue the approach, possibly bowing to economic and competitive pressure, while blaming ATC for their predicament.

The controller who issued this clearance certainly did not intend to cause difficulty for the crew. It is likely that this was the best solution to a problem, or possibly the controller was thinking that he was doing the crew a favor by giving them a short cut. However, would the clearance have been issued differently if the controller had a good understanding of the performance characteristics of this type of aircraft, and the required elements of a stabilized approach?

It is evident to a pilot, who operates transport category aircraft, that there is a lack of understanding by some controllers of many basic aspects of aircraft operation and flight crew responsibilities. Unexpected changes with little notice are difficult in highly automated aircraft. A common example would be the close in runway assignment change. The flight crew is required to reprogram the flight management system, review the approach chart, re-brief the approach, and ensure that a stabilized approach can still be achieved. In addition, it is common to brief a runway exit point and anticipated taxi route to the terminal. The workload may be so high at this point, that it may only be possible to set up the FMS and complete required checklists. The briefings may be shortened, and important information may be missed. In addition, the non-flying pilot will certainly be "heads down" for an extended period during a critical phase of flight. Is it possible then for a crew to handle a runway change? Of course, but it is important that the possibility be conveyed to the crew early on, so that proper planning and briefings can be accomplished.

Non-normal or emergency situations also create higher than normal workload, and it is important that ATC understand that flying the aircraft and prioritizing tasks are the crew's main focus. It may be difficult for the crew to communicate until certain checklists have been accomplished. Standardized ATC communications and procedures for distress aircraft would be helpful.

While the service provided by air traffic services is normally excellent, the lack of understanding, or "disconnect" between flight crews and controllers causes unnecessary difficulties and inefficiencies. This can lead to increased errors and a reduction in a margin of safety. Any program that addresses improved coordination and transfer of information should be encouraged. Increasing economic and

scheduling pressures on flight crews, as well as increased pressure on controllers to handle more capacity makes this even more important.

The safe completion of a flight - while maintaining the highest margin of safety - is the goal of every pilot, controller, and aviation professional. Organized pilot/controller educational programs may be an important element in ensuring that air travel remains the safest mode of transportation.

2.5 Overview of Survey Responses

Air Traffic Controller Responses

Air traffic controllers were surveyed on topics they thought pilots misunderstood about air traffic control; information about air traffic control they thought could benefit pilots; and, suggestions for ways that pilots could improve communication/coordination with ATC. Below is a sampling of these responses, as well as selected quotes from other sources:

General Misconceptions about ATC

- "I wish pilots understood that ATC separates airplanes from not only other airplanes, but airspace as well."
- "Many pilots had a misunderstanding of the ATC interpretation of a MAYDAY call, and do not fully appreciate that this call will ensure that the ATC unit concerned will immediately take certain actions on receipt of the call." *(Guidelines for Controller Training in the Handling of Unusual/Emergency Situations, EUROCONTROL, 2003)*
- "That we can easily approve any and all requests that they have, that the sky is really empty and that they can just do what they want without consequences to others flying within the system."
- "A quiet radio doesn't necessarily indicate controller isn't busy."
- "Pilots often believe that controllers will initiate vectors to steer them clear of weather areas."
- "All airports aren't created the same and neither is the airspace around the country. What works well in one place won't work well in another due to the traffic flows or lack thereof due to obstruction, lack of runways, etc."
- "I wish pilots better understood the constraints and limitations of the NAS (National Airspace System) to accommodate requests, such as direct routings, altitude changes, etc."
- "We are doing more that just talking to them at any given moment."
- "I believe pilots do not understand that for every change made in their routing or altitude, there is usually a need for "paperwork" to follow, e.g. a flight plan amendment."
- "Pilots do not grasp the concept of 'delegated airspace' and the reason controllers just can't 'look and go.'"
- "There is very little understanding among pilots about the need for controllers to coordinate with each other."
- "We are actually busier than they think we are and that we are normally watching many more things than they are aware of."

Information about ATC that Could Benefit Pilots

- Radar fundamentals – ATC can see only ground track & ground speed.
- Separation requirements.

- Large diversity of aircraft under ATC control.
- Airspace limitations.
- Frequency limitations for controllers (keeping radio transmissions concise, etc.).
- Effects on controller workload when deviating for weather or when not providing adequate notification when unable to comply with ATC instructions.
- Pilots could benefit by seeing "the actual sectorization that exists and how this determines what clearances are issued when."
- "Local and ground controllers *verbally* coordinate runway crossings."
- "The value of documenting errors or deviations – not for punitive purposes, but for safety improvement by discovering latent conditions."

Suggestions for Pilots to Increase Effectiveness of Communication/Coordination with ATC

- "Increase training on phraseology and radio technique."
- "Listen to transmissions not for you to get the big picture."
- "Always, ALWAYS, use a call sign."
- "Inform controllers when unsure of procedures, when uncomfortable with a control instruction, or when requiring additional assistance."
- "PLEASE go to facilities and see what the issues are, and get involved with your local safety program."

Pilot Responses

Likewise, pilots were surveyed on topics they thought controllers misunderstood about flying; information about pilot responsibilities they thought could benefit controllers; and, suggestions for ways that controllers could improve communication/coordination with pilots. Below is a sampling of these responses (paraphrases of responses are not in quotes).

General Misconceptions about Flying

- "Even though pilots are trained (to a certain extent) in ATC procedures, there are still a variety of procedures and rules relating to traffic control that pilots may not be aware of. Explain to pilots why you give certain instructions, thus giving pilots a better understanding."
- "There are a lot of things going on other than holding heading and altitude."
- "The multitasking required to teach, fly, and communicate with ATC sometimes causes ATC communication to be a lower priority than other tasks. A two-second wait time for a response for a pilot may not be adequate."
- "For flight instructors, the complexity of trying to divide attention between teaching a student and communicating with ATC."
- "Pilots do appreciate and value controllers. Pilots don't intentionally ignore instructions."
- "Pilots don't intentionally miss radio calls. If we miss a radio call, it's usually because we are doing something that would affect the safety of the flight."
- "The cockpit is a complicated environment and just like controllers get saturated with workload, pilots are susceptible to the same workload saturation."

Information about Pilot Responsibilities that Could Benefit Controllers

- Effects of runway changes during approach.
- Pilot work load during different phases of flight.

- Effects of automation, especially during approach and landing.
- Stabilized approach criteria and requirements.
- Pressures to minimize noise abatement and fuel consumption.
- The role of dispatchers and operational control centers.
- Cockpit environment during aircraft emergencies and extreme weather.

Suggestions for Controllers to Increase Effectiveness of Communication/Coordination with Pilots

- Establishing contact with counterpart (i.e., 'break the barrier' with flight operations) to address a problem.
- "Keep training/low-time pilots within gliding distance from airport."
- "Don't vector training flights over water."
- "Both jobs (ATC and pilot) are stressful and empathy is the best thing to try and maintain."

2.6 Comparison of Education and Training Processes for Pilots and Controllers

The education processes for pilots and controllers differ in the number and variation of institutions that offer a path to certification. Pilot education and training is much more decentralized, with private flight instructors, community colleges and universities, the military, and airlines all providing training. Air traffic controller education is handled by a relatively few large organizations such as civil aviation administrations and national ATC service providers, as well as a small number of approved colleges and the military. These education providers necessarily focus on their respective core content (i.e., flight training for pilots, ATC training for controllers). The question WG E has raised, however, is "Can safety and operator efficiency be improved by including more information about their counterparts on the other end of the radio?"

ATC Education

Below is a *preliminary* overview of the flight operations training requirements for air traffic control educational institutions. It excludes ATC-related requirements as well as general-study topics.

1. FAA Air Traffic Control Collegiate Training Initiative (CTI) Plan of Study

   In 1990, the Federal Aviation Administration (FAA) established the Air Traffic Collegiate Training Initiative (AT-CTI) program for employment of Air Traffic Controllers. Graduates, who meet Air Traffic Control Specialist (ATCS) basic qualification requirements, may then be considered for employment in Towers and En Route Centers. This program's plan of study includes the following flight-related topics:

   - Fundamentals of Flight
   - Aircraft Propulsion Systems
   - Aircraft Operating Systems
   - Instrument Flight
   - Airline Operations

2. The EUROCONTROL Controller Training
   According to the Common Core Content, this includes the topics "Navigation, Aviation and Aircraft (relevance of theory of flight and aircraft characteristics on ATS operations)," "Principles of Flight," "Aircraft Engines," "Aircraft Instruments," "Aircraft Categories," "Factors Affecting Aircraft Performance," and "Expectations and Requirements of Pilots."

3. The University of Alaska Aviation Technology Division Degree Program in Air Traffic Control
   Requires ATC students to complete a 3-credit Private Pilot Ground School class.

4. Embry-Riddle Aeronautical University (Florida and Arizona, US)
   Requires ATC students to complete the course "Principles of Aeronautical Science."

5. Hampton University (Virginia, US)
   Requires ATC students to complete the course, "Aeronautics/Private Pilot."

6. The Community College of Beaver County (Pennsylvania, US)
   Requires ATC students to complete a Private Pilot Ground School class as well as a course, "Theory of Instrument Flight."

Pilot Education

Below is a *preliminary* overview of the ATC-related course requirements for selected flight education institutions in the United States.

1. Embry-Riddle Aeronautical University (Florida and Arizona, US)
   The Bachelor of Science degree in Aeronautical Science at Embry-Riddle Aeronautical University requires courses in Airline Dispatch Operations and Domestic and International Navigation, but there are no specific requirements for courses in air traffic control.

2. University of Maryland Eastern Shore
   Requires students in the professional pilot bachelor's degree program to take one course in Air Traffic Control.

3. Western Michigan University
   Western Michigan University's Bachelor Degree program in Aviation Flight Science does not require the completion of a course in air traffic control. Courses in interpersonal and technical communication are required.

4. Purdue University (Indiana, US)
   Students are not required to complete a course in air traffic control for the Bachelor Degree Program in Professional Flight Technology. Completion of the Advanced Navigation course is a requirement.

5. University of North Dakota
   The Bachelor Degree programs in Aviation Management and Flight Education both require students to complete the course, "Introduction to Air Traffic Control."

6. Florida Institute of Technology
   The Florida Institute of Technology School of Aeronautics Bachelor Degree in Aeronautical Science (Flight Option) requires that students take one course in air traffic control.

Currently, neither the FAA in the United States nor JAA in Europe mandates that pilots complete any formal training in ATC subjects. However, many aviation educational institutions – a few of which are listed in the sections above – require degree-program students to take formal air traffic control courses. Once a student has graduated and entered his or her career field, many familiarization schemes are operated locally and regionally by interested and motivated pilots and controllers (see WG E report, "Pilot/Controller Collaboration Initiatives: Enhancing Safety and Efficiency" for a sampling). However, these are run less frequently due to security problems such as company rules regarding access to flight deck and civil aviation regulations prohibiting visits to air traffic control facilities. Also, increasing costs and revenue pressures on airlines and ATC organisations have limited the development and continuation of these valuable familiarization programs.

A student pilot who is enrolled in a training or education program that leads to a pilot's license may very well receive little or no training in air traffic control. In addition, it is likely that he/she will be trained at a non-controlled airport with the express purpose of *not* being required to interact with ATC. This approach is not entirely without merit considering the priority placed on first learning how to aviate and navigate the aircraft safety. However, once the pilot earns his/her license and is no longer in a structured training environment, the pilot's career path will require him/her to interact more frequently with ATC. During a pilot's career development, future employers often assume that ATC-related knowledge has already been gained, and WG E has found no significant pattern of ATC education in initial or recurrent training requirements at airlines, large or small. Where, then, are pilots expected to gain knowledge about ATC?

Likewise, air traffic control students may not be exposed to valuable knowledge about flying if he or she is not enrolled in an educational institution with such requirements. Where will controllers learn about the cockpit environment?

3.0 Treatment: Addressing Pilot and Controller Misconceptions

3.1 Incorporating Pilot/Controller Collaboration in Training and Education

While time and resource constraints cannot be ignored in the quest to encourage incorporation of "cross-educational" topics in pilot and controller training programs, the benefits of learning more about how operators at the "other end of the radio" are becoming more apparent and should also be taken into consideration. A pilot who is taught early in his or her career about ATC operations will improve his/her performance through a better understanding of the environment in which controlled flight occurs, and a controller will improve his/her ability to provide control instructions and assistance by knowing more about the flying.

Understanding the priorities of the other will assist pilots and controllers in determining whether to accept or decline certain operational requests. For example, suppose a controller issues a runway change thinking it will benefit the pilot by reducing taxi time to the terminal. Suppose also that this instruction increases workload at a critical phase of flight, and the pilot would prefer not to accept it. If the controller had a more complete understanding of the pilot's workload, he/she may not have issued the runway change. Likewise, if the pilot understood that the change may not have been mandatory, he/she could inquire if the change was indeed needed. IN a scenario where there was greater mutual understanding, the runway change may not have been issued or the pilot may have inquired if it was indeed needed.

Flight education schools can create requirements for "cross-educational" courses to ensure that pilots and controllers are exposed to each other's field of study. Currently, many schools offer these topics as electives, but they could be made mandatory. However, without a regulatory approach by civil aviation authorities, these changes will only affect a small percentage of future pilots and controllers. Pilots who gain their licenses outside structured degree programs would not benefit from these changes either.

One example of a regulatory approach to incorporation of flight topics in ATC training can be found in Europe. The EUROCONTROL "ATCO Basic Training – Training Plans" recommends to its members states to include the following training topics in initial training for air traffic controllers:

- Factors affecting aircraft performance
- Aircraft performance
- Structural components and control of an aircraft
- Aircraft engines
- Aircraft instruments
- Aircraft categories

It should be noted that the training requirements of other regulatory bodies and civil aviation authorities have not yet been analyzed for inclusion in this interim report, but this example in a major aviation region indicates that this approach is feasible.

3.1.1 For Pilots: Sample Course Material on ATC Topics in Pilot Education/Training Courses

The following recommendations for ATC topics to be included in pilot education and training courses have been documented by WG E through surveys, personal interviews, and research activities:

- How flights transition through the NAS. For example, why it is necessary for controllers to have a published/printed flight plan/flight progress strip. Differences in flight management capabilities in Centers vs. Terminals. How reroutes and altitude changes require manual controller input into NAS computer, and how this "slows down" system with respect to weather-related deviations.
- How a "data block" is generated (discrete beacon codes) and how being within radar coverage of a controller's radar screen does not necessarily mean "radar contact".
- Why "direct" routings are not often possible.
- Air Traffic Controllers' lack of authority to close an airport, and how this fact relates to the pilots' ultimate decision to takeoff or land in inclement conditions.
- The primary responsibility of Air Traffic Controllers (the separation of aircraft).
- Controller and responsibilities during different types of approaches.
- Separation requirements of simultaneous/staggered ILS Approaches.
- The controller's reasons for issuing speed control (spacing) versus the pilot's understanding of speed adjustments (aircraft configuration). Emphasize impact of pilot initiated speed changes on controller.
- Rate of Turn; Controllers base separation and sequencing by anticipating that aircraft will conduct a standard rate of turn (i.e., 3 degrees per second).
- Limitations of usefulness in querying a controller as to "sequence." Question formats such as "when can I expect a base turn?" or "how long is the final?" should be encouraged instead.
- Separation standards for turbojets departing vs. arriving aircraft and vice-versa (e.g., 6000 feet and airborne rule).
- Controller requirements with regard to traffic advisories (some are mandatory).
- Limitations of "visual separation".
- Regulatory requirements and operational/safety benefits of standard phraseology.
- Implications of reading or not reading back an ATC clearance.
- Variety of communication requirements in ATC facilities, such as landlines, ground radios, etc.
- Need for timely frequency changes by pilots. For example, during simultaneous ILS approaches, separation is dependent upon aircraft being on the correct frequency.
- Wake turbulence separation requirements.
- Personal priority requirements of controllers ("first come-first served, emergency flights, "Lifeguard" flights, etc.).
- Emergency ATC procedures when there is a Dangerous Goods warning.
- Importance of assertive and timely questioning of clearances which appear inappropriate.
- Large diversity of aircraft under ATC control, and limitations of aircraft information available to controllers.
- Airspace limitations.

- Effects on controller workload when deviating for weather or when not providing adequate notification when unable to comply with ATC instructions.
- Mechanism for coordination between local and ground controllers (e.g., they verbally coordinate runway crossings). Also, the prohibition of conditional clearances in some States.
- Requirements for handling “emergency fuel” versus “minimum fuel” flights.

The following recommendations have been offered by the FAA Office of the Chief Scientific and Technical Advisor for Human Factors for reducing the number of communication errors between pilots and controllers:

- **Pilots should respond to controller instructions with a full readback of critical components.** An altitude, heading, or airspeed should be read back as an altitude, heading, or airspeed. For example, "Climbing to 230, Aircraft XYZ" contains critical information that "Roger, 230 for Aircraft XYZ" does not. When more than one runway is in use, clearances to takeoff and land should be acknowledged with a readback of the clearance that includes the runway number.
- **When there are similar call signs on the frequency, pilots should be encouraged to say their call sign before and after each readback.** This gives the controller added information as to which aircraft accepted the clearance.
- **Controllers should refrain from issuing "strings" of instructions to different aircraft.** Issuing strings of instructions to different aircraft without allowing the opportunity for each aircraft to respond directly after the controller's transmission has two undesirable effects. First, it increases the likelihood of a miscommunication. A pilot's memory for an instruction can be hindered by extraneous information presented before or after it. Second, it decreases the likelihood of a pilot readback, as it sends the message, "I'm too busy for your readback to be important right now".

3.1.2 For Air Traffic Controllers: Sample Course Material on Flight Training Topics

The following recommendations for flight-related topics to be included in ATC education and training courses have been documented by WG E through surveys, personal interviews, and research activities:

- Functioning of the Flight Management Computer in general.
- Effects of late changes of runway prior to takeoff and the deletion of takeoff speeds.
- Speed requirements (take-off, clean aircraft, climb, cruise, descent and approach).
- Limitations on the approach (crosswind and tailwind components, dry runway, wet runway, etc.).
- Time requirements for deceleration.
- Aircraft configuration.
- Difficulty in manoeuvres for “reducing and descending” without prior warning.
- Conditions for accepting ATC instructions.
- Role of aircraft dispatch and operational control centers.
- Reasons for speed restrictions.
- Procedures in case of a flight emergency.
- Management of emergencies in various phases of flight.
- Pilot work load during different phases of flight.

- Effects of automation, especially during approach and landing.
- Stabilized approach criteria and requirements.
- Pressures to minimize noise abatement and fuel consumption.
- TCAS actions.
- Hydraulic failure vs. engine failure

The following recommendations have been offered by the FAA Office of the Chief Scientific and Technical Advisor for Human Factor for reducing the number of communication errors between pilots and controllers:

- **Controllers should be encouraged to speak slowly and distinctly.** In a laboratory study, the rate of pilot readback errors and requests for repeats more than doubled when the same controller gave the same complex clearances in a faster speaking voice. With a normal rate of speech (156 words per minute), 5% of the controller's instructions resulted in a readback error or a request for repeat. This rate rose to 12% when the controller spoke somewhat faster (210 words per minute) (Burki-Cohen, personal communication). (As a reference, the average newscaster speaks at about 180 words per minute.)
- **Controllers should be encouraged to keep their instructions short with no more than four instructions per transmission.** The complexity of the controller's transmission has a direct effect on the pilot's ability to remember it - there are fewer pilot errors with the less complex transmissions.
- Controllers should try to treat the readbacks as they would any other piece of incoming information - use it. **Actively listen to the readback and check it against the flight strip notations** to ensure that the message that the pilot got was the one you wanted him or her to get.
- **When there are similar call signs on the frequency, controllers should continue to announce this fact**; this will alert pilots and may help to reduce the incidence of pilots accepting a clearance intended for another aircraft.

3.2 Pilot/Controller Collaboration at the Operational Level

Collaboration can come in many forms, all of which can be effective at increasing mutual understanding between pilots and controllers. The opportunities for pilots and controllers to collaborate at the operational level will vary depending on such things as work schedules, available meeting space, management and union support, and the location of a pilot hub near an ATC facility. These and other factors will determine the viability and extent of collaborative initiatives, but whatever level of collaboration is used, the very interaction between pilots and controllers will be beneficial.

Below is an overview of the strata of collaboration initiatives used in various locations:

Hierarchy of Collaboration

1. "Casual Interaction"
   Individual pilots and controllers talk on the telephone or meet sporadically to discuss operational issues brought up by their colleagues or first-hand experiences. This is a necessary first step for

any other collaboration to take place, and is often quite effective in resolving minor issues and developing good working relationships between pilots and controllers.

2. "Regularly Scheduled Meetings"
   The meeting time and place for this type of collaboration is structured, but the activities and agenda for the meetings are either unstructured or at least very flexible. The regular in-person interaction between pilots and controllers allows for larger scale, more complex solutions to be developed.

3. "Structured Interaction"
   Not only is the meeting time/place established in advance, but the agenda is detailed, with specific goals and objectives for pilot/controller interaction. The interaction can take place in a classroom, aircraft cockpit, or ATC facility. A dedicated staff person is often required to maintain this type of collaboration initiative.

4. "High Technology"
   With adequate resources and organizational support, some operators have been able to use technology to link flight simulators and ATC simulators. Not only can pilots and controllers practice procedures collaboratively, but they can also observe the other's work environment and even take each other's place to experience for themselves what it is like on the "other end of the radio."

3.2.1 National/International Initiatives

The collaboration of pilots and controllers for the improvement of aviation safety is being accomplished formally in a variety of contexts around the world. This section highlights some examples of situations where pilots and controllers have formally worked together on a large (national or multi-national) scale and outlines the benefits drawn from the interaction. In the following section, local initiatives are documented, showing how individuals and small groups of people can make improvements in their local operating environment. These and many other initiatives are more completely documented in the WG E Report, "Pilot/Controller Collaboration: Enhancing Safety and Efficiency," available for fee download at www.gainweb.org.

While there are many national and multi-national programs, five examples are discussed in this section:

Operation Raincheck: Pilots seeing the controller's point of view

Operation Raincheck is a program begun in the 1960's and administered by the Federal Aviation Administration in the United States for pilots. It is designed to familiarize pilots with air traffic control: its benefits, responsibilities, functions, problems, services available and relationship with all facets of aviation. It is intended for pilots of all skill levels, from the student pilot to the most senior commercial pilot to gain a quick overview of what a controller does and how it affects them as a pilot. Operation Raincheck is a free one-day seminar generally given at the various FAA Air Route Traffic Control Centers. Historically, the sessions were large gatherings of over 100 pilots to learn about air traffic control. Recently, a number of centers have restructured into smaller classrooms with about 15 pilots allowing for one-on-one interaction and answering questions.

There are numerous learning objectives of Operation Raincheck:

- Learn how TRACONs, centers and FSSs operate
- Learn about radar control and vectors
- Learn about VFR flight following
- Learn why aircraft are delayed and/or rerouted
- Learn about weather and its effects on ATC
- Learn about bottleneck problems, conflict alerts, handoffs, and what is required to separate aircraft in the sky

The program is designed to be multi-media and as hands-on as possible. Participants in Operation Raincheck have an opportunity to monitor an active sector and hear first hand from the working controller about what they are doing. Many centers have a lab of training radar scopes available to the Operation Raincheck program. Participants have an opportunity to set up a stream of arrivals for approach control in the simulation lab.

Pilots state that the primary benefit of the Operation Raincheck program is to see first hand just how challenging the controller's job is. Feedback from pilots includes:

- "I had no idea that so much went on behind the scenes,"
- "It was the best learning experience that I have ever had in ground school," and
- "I have learned things that will make me more aware of how to make me a safer pilot as well as being more in tune to controller constraints."

Jumpseat Program: Controllers seeing the pilot's point of view

The complement to the Operation Raincheck program is the Jumpseat, or Familiarization Program. A familiarization flight is one in which an air traffic controller is permitted to observe the pilots in the aircraft cockpit during flight. This allows the controller to experience the operation of the aircraft, see the interaction with the air traffic control system first hand, and better understand cockpit procedures and piloting. Familiarization flights have historically been provided by the many agencies and organizations (e.g. FAA and NAV CANADA) to controllers on a periodic, ongoing basis. The flights are considered a key component of on-the-job training.

From their perspective, controllers have provided similar feedback about this program that pilots often provide about their experience with Operation Raincheck. They say that the experience is often eye opening for them as it helps them to truly visualize the cockpit environment better than solely ground-based training sessions. They report that when they return to their workplace to control air traffic, they have a much better picture of the environment in which the pilot is operating, and this aids their interaction with the pilots.

Gate to Gate: A multimedia experience to learn about air traffic control

Gate to Gate is an educational tool that introduces students to the air traffic management system, including the people, tools and work of air traffic control. It consists of a CD-ROM and accompanying

Student Activity Packet, and was developed in cooperation with the Federal Aviation Administration (FAA) and the National Aeronautics and Space Administration (NASA) Ames Research Center.

The purpose of Gate to Gate is to familiarize students with the air traffic system, and although it is primarily targeted to students interested in ATC careers, it can be used as a comprehensive introduction for future and current pilots as well. The interactive CD-ROM contains video of controllers explaining their roles in a controlled commercial flight, information on new tools in use or development, and brief quizzes on ATC. One of the primary benefits to non-controllers is the visual experience of footage inside control towers, approach/departure control facilities, and enroute control facilities, which will assist pilots in understanding the environment inside an ATC tower or radar room. The CD-ROM demonstration is divided into 7 sections: Preflight, Takeoff, Departure, En Route, Descent, Approach and Landing. Each section is a phase in a commercial flight profile, and provides information about the air traffic management system's contribution to each phase of a commercial flight.

The student activity packet and CD-Rom are available for free download online, including at the National Air Traffic Controllers Association website at www.natca.org, or by contacting Karen Stewart at +1 (202) 267-9840 or at karen.stewart@faa.gov.

NATCA Safety Committee's Communicating for Safety: An open industry forum for dialogue

Each year the National Air Traffic Controllers Association Safety Committee puts on a seminar called "Communicating for Safety." This is a two-day meeting on issues that are important to both pilots and controllers. It is open to all pilots and controllers and encourages discussion and an open forum to ask questions of industry and government decision makers.

The conference objective is for pilots and controllers to help plot the course of the industry through the open exchange of information. Participants are encouraged to interact with speakers and other conference attendees and work together to develop new ideas for the future of aviation safety.

The topics of discussion for the 2003 conference in Denver (April 29-30, 2003) included national airspace redesign, RNP/RNAV, Operational Evolution Plan (OEP), ADS-B, and runway safety. Generally, the focus is on system, procedures, and communication problems. The discussions focus on reasons why errors occur and solutions to prevent them from happening in the future. Air traffic controllers, pilots, Federal Aviation Administration officials, and other industry stakeholders attend to share their thoughts and experiences as speakers or panel members.

ICAO GREPECAS Aviation Safety Board: Collaboratively Identifying Deficiencies In The Air Navigation Plan For Immediate State Resolution In Latin America & Caribbean

At the August 2000 meeting of GREPECAS (The Caribbean and South America Regional Planning and Implementation Group of the ICAO), the Aviation Safety Board was established. It provides a forum where the deficiencies in the air navigation plan, characterized as safety impairments, can be identified for immediate State resolution.

The Aviation Safety Board is a relatively small group where pilots, controllers, and airlines are represented by IFALPA, IFATCA and IATA. The Regional Office Safety, Operations and Infrastructure Latin America & Caribbean of IATA has been the promoter of this initiative, becoming

the first region in the world to have an ICAO Aviation Safety Board that provides a direct link to the States to deal with safety deficiencies.

Air Transport Operations Consultation Committee (ATOCC): Providing A Forum Of Consultation Between NAV CANADA And Its Major Customers

The purpose of the ATOCC is to provide a forum for consultation on technical and operational issues, together with their financial impacts, between NAV CANADA and major commercial Air Navigation System (ANS) users and customers on a regular and ongoing basis. Because of the significant changes likely to occur over the next 10-20 years, frank and open consultation with the committee on changing requirements and infrastructure is important. This forum also helps to identify the priorities and requirements of the main system customers. Subcommittees may be formed to examine specific issues.

The NAV CANADA Vice-President of Operations is chairperson of the ATOCC, with other members coming from different departments in NAV CANADA, the International Air Transport Association (IATA), the Air Transport Association of Canada (ATAC), the Air Transport Association (ATA), Air Canada, Canadian Airlines International (CAI), US Airways, Air Nova, Canadian Regional Airlines, Alaska Airlines, Delta Air Lines and United Airlines and Air Transat. At the Chair's discretion, and in consultation with ATOCC members, other customers may be invited to participate in the work of the committee when applicable. Committee members who are not NAV CANADA employees serve without NAV CANADA compensation and bear all costs related to their participation on the committee.

There are numerous objectives of the ATOCC:

- Identify ANS issues that are of concern to the member organisations and examine options of addressing them.
- Examine ways of enhancing traffic flow, safety and operational efficiency.
- Discuss ANS related topics such as air navigation, airspace management, communications, air traffic control, and flight information services.
- Examine specific ANS plans and programs and the various options for their implementation.
- Examine proposed changes to existing facilities and services and strive to implement a smooth transition to any new infrastructure.
- Examine ways of minimizing the impact of system changes on human resources.

The Air Transport Operations Consultation Committee (ATOCC) became effective May 8, 1997. The duration of the committee will be as required and as determined by a consensus of the members. Meetings are held as needed and at least twice a year.

3.2.2 Local Initiatives

Amsterdam, Netherlands (EHAA)
"Reducing Approach and Landing Accidents through Communicating and Understanding"

The Flight Safety Foundation (FSF) International Approach and Landing Accident Reduction (ALAR) Task Force's goal is to reduce by 50 percent the worldwide fatal approach and landing accident rate. One of the major conclusions of the task force, based on an analysis of worldwide accidents was,

"Improving communication and mutual understanding between air traffic control services and flight crews of each other's operational environments will improve approach and landing safety."

The tasks of pilots and air traffic controllers are complex and each task is executed under heavy workloads, along with a major overlap of shared tasks and responsibilities. The development of crew resource management (CRM) has improved communications between crewmembers immensely and has already paid back initial investments. Results of the ALAR studies reveal that the next challenge is to create a CRM-like program between pilots and controllers. Two different mental worlds exist for pilots and controllers:

- The pilot's world: focused on one airplane with its complexity, pressure of time restrictions, shortened turn-around-times, shortened flight times, and demands for high productivity.
- The controller's world: focused on traffic flow with multiple aircraft present on his/her scope, pressure to increase capacity of landing/take-off runways, reduce landing intervals, reduce radar separation minima, use complex multiple runway combinations.

To contribute to the accomplishment of the ALAR goal and to help achieve and share a common mental model between pilots and controllers, in 1993 ATC The Netherlands training department in conjunction with KLM Royal Dutch Airlines developed a training program focusing on the theme of "Aircraft Emergencies and the Role of ATC." The program had two main elements: (1) flight simulator sessions for air traffic controllers and (2) mutual discussion meetings between pilots and controllers.

Flight Simulator Sessions for Air Traffic Controllers: The objective of this element of the training program was to promote the understanding of limitations, workloads and operational requirements of the flight deck crewmembers during unusual situations. To achieve the objective, controllers played the role of pilots in scenarios involving emergency situations (e.g. engine fire, arrival segment encountering landing gear problems) and an ATC instructor simulated ATC.

The sessions began with the ATC instructor explaining the purpose of the session to a pair of controllers who were playing the role of pilots. This was followed by a KLM flight instructor providing a 30-minute basic Boeing 737 cockpit training course to the controllers. The roles and tasks to be completed during the emergency were made clear to the participants. By actually experiencing the workload, task complexity, limitation of time and variety of decision making of the pilot's tasks in the flight simulator, the controllers' reactions were encouraging. Examples of comments from the controllers include: "Better than my familiarization flights so far," "actually an eye opener," and "objectives of this training session are reached and beyond that many more."

Mutual Pilot and Controller Meetings: Pilots and controllers were invited to participate in discussion sessions related to "Aircraft Emergencies and the Role of ATC." The main objective of the discussions was to keep both parties informed of current procedures and common programs to improve communications during an unusual event.

In preparing for the meetings, KLM and ATC Netherlands worked together with pilots and controllers to find an incident that would be of interest to the participants. An actual incident in which one of the controllers and one of the pilots had been involved was selected for discussion. Although the incident involved a departing aircraft, the communication and interplay between ATC and the cockpit crew were

the main topics and could be freely transferred to the approach and landing phase of flight. The incident was made known to the meeting participants, open discussions were held and the current procedures were "mirrored."

In total 321 ATC personnel and 243 pilots have attended these meetings and concluded that they were extremely successful. Very useful recommendations were made to improve ATC procedures and were promptly introduced by management. The meetings were successful in creating awareness and understanding among aviation professionals. One output from the meetings is a very useful tool for ATC controllers encountering a Pan Pan or Mayday call:

A – Acknowledge - make sure you understand the nature of the emergency.
S – Separate - don't forget to establish or maintain separation with other aircraft or terrain.
S – Silence - impose silence on your frequency.
I – Inform - supervisor, colleagues and airport concerned.
S – Support - give maximum support to pilot and crew.
T – Time - allow pilots sufficient time to work on their problem.

Teamwork in aviation normally creates synergy and wonderful ideas. The ultimate challenge is to work together towards an even safer aviation industry.

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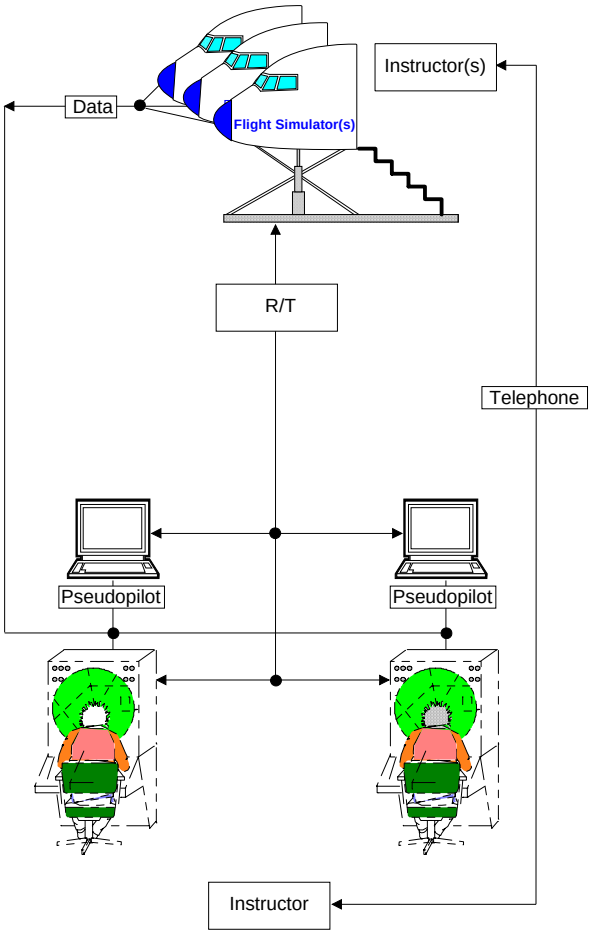
Frankfurt, Germany (EDDF)
"Joint Operational Incidents Training: Linking Simulators"

Joint Operational Incidents Training is a shared training program for air traffic controllers and pilots based on a network consisting of an ATC radar simulator and different flight simulators. JOINT was developed on the basis of the realisation that any simulation in this field can only be as good as the simulation environment. While simulator performance has become better during the last years, the simulation environment has not received the attention it deserves. Normally in flight simulation, there is no ATC environment at all, or it is simulated by the flight instructor only; in this case, other traffic is not simulated. In ATC radar simulations, pseudo pilots play the role of real pilots by steering targets on a computer. However, they are not under the same level of stress as is experienced in real emergency situations in a real cockpit. Therefore, it was only logical to combine both simulation systems and improve the training of unusual situations on both sides.

A Deutsche Flugsicherung (DFS) radar simulator has been installed for the JOINT program in the Lufthansa Flight Training (LFT) Center at Frankfurt Airport. The system is comprised of two radar controller and two coordinator positions to enable simulation of two different sectors at the same time: an approach sector and an area control sector. The radar simulator is linked to the flight simulation network of LFT by two interface computers. Position data from the flight simulators are transferred by this interface to the radar simulator so that the positions provided by the flight simulators are displayed on the radar screen together with the simulated traffic of the pseudo pilots. The frequency is also linked by one interface so the pilots can hear all other traffic and can communicate with their respective controller of the simulated sector. The DFS instructors can talk to the training captain in the flight simulator by telephone. Currently, eight different flight simulators can be connected and participate at the same time.



At this time, a scenario of Langen ACC sectors is simulated in combination with either Frankfurt, Nürnberg or Stuttgart APP. Expansion to Berlin ACC sectors in combination with Berlin APP is planned and will start shortly. There are plans to expand the JOINT program to other DFS control units in Germany.

The kind of emergencies which are simulated vary from aircraft type to aircraft type and also change from time to time. All flight simulators encounter programmed emergencies as a function of prescribed times, positions or altitudes. Some examples:

- B747: Take-off at EDDF. Loss of thrust in one engine in the late take-off phase (after decision speed V1). Departure on either SID or EOSID (engine out SID) and possibly fuel dumping in the ACC sector (about 30 minutes)
- Crew: Decision about route (SID), fuel jettison yes/no. Ask for instruction and help by ATC about dumping area and return to EDDF.
- ATC: Use checklist "Engine Failure and Fuel Dumping" part.
- A300: Entry into Frankfurt FIR. Approach to EDDF without delay. In the late approach phase in the APP area, go-around due to flap problems. Another approach to EDDF.

- Crew: Decision for a go-around, thereafter delay in order to be able to deal with the problem. It is not an imminent emergency.
- ATC: Emergency, yes or no? Delay vector required?
- B737: After take-off when passing FL130, loss of both main hydraulic systems, leading to enormous steering pressure, difficult landing with likeliness to crash. The cabin has to be prepared for this purpose and high stress level in the cockpit. ("Manual Reversion," about 20 minutes until "ready for approach")
- Crew: Request of level band and delay vectors by ATC to get time for the preparation of the cabin.
- ATC: Checklist A15 "Hydraulic Problems." Assigning a level band, no regular holding.

The major training objective of JOINT is “Maintenance and improvement of professionalism and competency of air traffic controllers, in particular, in the handling of emergency and unusual situations.”

Thanks to the JOINT program, air traffic controllers can now perform training together with airline pilots in a realistic scenario; this will help controllers deal with unusual situations that may occur in the cockpit, for example, by:

- assessing the requirements of pilot and aircraft;
- assessing and considering the workload of the cockpit crew;
- offering immediate and efficient support.

In the JOINT program, the above-mentioned objectives are achieved by means of the following training contents and processes:

- Improving communication and/or making it more objective by unambiguous and unmistakable communication between cockpit crew and air traffic controllers;
- Complying with the prescribed procedures and standards (phraseology, separation, operational regulations, etc.) by efficient coordination, cooperation and communication (Team Resource Management - TRM);
- Learning how to safely apply the emergency checklist which is available at all controller working positions of DFS;
- Accompanying pilots in the flight simulator and observing the work flows in the cockpit during an emergency;
- Exchange of experience and information between cockpit crews and air traffic controllers by holding a concluding debriefing together.

This module plays an important part in the JOINT program. The personal contact helps air traffic controllers to understand processes and workloads in the cockpit and also to describe their own problems in ATC. A better understanding of each other’s job can be gained by mutual discussions. The debriefing takes place in the room where the radar simulator is installed. The recorded run can thus be replayed to the cockpit crew for illustration purposes.

Participants of the JOINT program have completed feedback forms on a voluntary basis since the beginning of 1997. The purpose of the feedback form was to document the acceptance and execution of the program.

The general question concerning the JOINT program has had a 100% positive feedback; this is also in line with the experience of JOINT instructors. The following answers are excerpts from completed forms:

- "I think the program is very well suited to provide a realistic course of events in an emergency situation (for both sides, pilot and controller)."
- "The JOINT program is a good tool to keep up or even improve the skills of air traffic controllers in the case of emergencies! It is even a good opportunity to keep in touch with the pilots!"
- "JOINT is a very useful supplement to simulator-flying and familiarisation flights. A good opportunity to share experiences of both controllers and pilots, observing each other performing their job."
- "Excellent, since very close to reality."
- "All air traffic controllers should take part in JOINT on a regular basis."

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Cleveland ATCT (KCLE)
"Complete ATC Seminar: The Pilot's Journey through the ATC System"

When the air traffic controllers in the Cleveland Airport Traffic Control Tower heard many stories about how general aviation and charter pilots viewed the air traffic control system with apprehension and fear, they decided to do something about it. Representatives from each air traffic control facility in the Cleveland area met with the Safety Program Manager at the Flight Standards District Office. Each facility provided for consideration a list of the most common misunderstandings/mistakes made by pilots in the general aviation community. Some examples were: poor radio technique, misinterpreted charts and runway diagrams, and inadequate pre-flight briefings. These representatives from the Cleveland Flight Standards District Office, Cleveland Air Traffic Control Tower, Cleveland Automated Flight Service Station, and Cleveland Center worked together to develop an informative program oriented to encompass the entire realm of air traffic services, packaged it, and presented it to the flying public in a two hour program-delivered to THEIR location. This program is known as "The Complete ATC Seminar, *The Pilot's Journey through the ATC System."*

"The Complete ATC Seminar, The Pilot's Journey through the ATC system" is a culmination of years of experience, from both the pilot and controller side of aviation. A panel of six air traffic controllers presents this "skit," representing how the ATC system really works anywhere in the U.S.

The ATC controllers are placed on one side of the stage and the "pilot" on the other. The separation between the two simulates the separation between a pilot in an aircraft and the controller in the ATC facility. Neither would acknowledge each other's presence except through telephone or radio transmissions. Additionally, each controller would only communicate with the other controllers via a simulated "landline." This would simulate the intra-facility communication between controllers via the computer. When the pilot contacts each different ATC specialty for the first time, that controller would give the audience a brief description of the function they perform in the system. For example, when the pilot calls the AFSS, he/she is placed on hold and the AFSS specialist that responds explains the services they provide. Throughout this skit the pilot acts as the director, initiating controller responses and actions, requesting routing, and obtaining needed information.

The participants conduct themselves just as they would in real life. The pilot calls for a weather briefing, files a flight plan, and simulates the communications normally made during an IFR cross-country flight. The controllers handle this flight just as they normally do, making radio transmissions, issuing clearances, and coordinating changes in the route of flight. The only difference is that all parties would be "thinking out loud" to the audience. The flight is planned: a rented single engine airplane is being used over a familiar route of flight at a low en route altitude. At no time is this flight any different than the thousands that are taken daily throughout the U. S.

One of the most unique aspects of this presentation is that the entire ATC system is represented. Flight Service, En Route/Center, Approach Control, and Control Tower are brought to the audience to present their area of expertise. During the entire "flight," mistakes are made and corrected by members of the team, but no sermons or criticisms are made, only straightforward and honest advice. No questions are addressed during the "flight," but afterward a question and answer session is held for members of the audience.

The primary benefit of this program is to de-mystify the air traffic control system and those who work in it. The pilots become familiar with the controllers, common misperceptions, workload issues, and what happens "behind the scenes" when they are flying through controlled airspace. The team of air traffic controllers and pilots have presented this seminar to over two thousand pilots, who have in turn given praise at all levels about the quality and content of the presentation. The seminars greatly bolster pilot/controller respect because they present everything and everyone at one place and time. Although never intended as such, this program has proven most effective in presenting all of the above material WITHOUT entering an Air Traffic Control facility. Therefore, security measures and costs are not a factor while every facet of the system is explored.

"The Complete ATC Seminar, *The Pilot's Journey through the ATC System"* is both informative and entertaining. It can be presented anywhere there is a need, and adaptation to local areas is possible.

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Charlotte ATCT (KCLT)
"RESAFE"

Analyzing Flight Operational Quality Assurance (FOQA) data from its Boeing 737 fleet, safety experts at US Airways noticed a trend at its major East Coast hub at Charlotte, North Carolina (KCLT). The data showed that higher-than-average percentages of flights going into KCLT were experiencing steep approach profiles, unstable approaches, and go-arounds on runway 23. A member of the US Airways Safety Group contacted KCLT and set up a meeting with NATCA and management to discuss, and hopefully solve, these issues.

To begin the effort, the facility manager at KCLT provided space for the meetings to take place, and both US Airways and FAA management authorized personnel time to attend the meetings. With management support and active participation of both NATCA and Air Line Pilots Association,

International (ALPA), several air traffic controllers and pilots met to find the cause or causes of the problems experienced by US Airways.

Although those that met thought that the solutions would be developed quickly, they found that there were going to be no simple solutions to the complex issues facing them, and there were more questions than answers being produced. They realized that there needed to be a significant improvement in education and communication between the pilots and air traffic controllers. Beginning in the fall of 1996, representatives from US Airways, ALPA, NATCA, and the staff at KCLT began working diligently to enhance their interaction, particularly in the area of training and quality assurance. In addition to these training classes, the pilots and controllers developed training sessions for each other:

- Pilots from US Airways prepared training sessions that covered aircraft performance characteristics, error management, effective communication, and flight crew responsibilities. They also held training classes at the US Airways' Training Center in Charlotte for the air traffic controllers and staff, and US Airways provided flight simulator time for controllers to experience first-hand the dynamics of aircraft approach capabilities and limitations.

- The air traffic controllers at KCLT developed a training session for the US Airways Check Airmen on topics such as airspace allocation, radar procedures, controller responsibilities, workload issues, and emergencies. The controllers offered pilots the opportunity to participate in Enhanced Target Generator (ETG) air traffic control simulations. Also, joint training sessions were conducted for US Airways Ramp Controllers and FAA Ground Controllers.

The program has been formalized, with numerous documents, training surveys, questionnaires, and statistical analyses on hand at the facility that testify to the tremendous value of these efforts to date. It has also garnered national attention and support from organizations such as NASA, FAA, ALPA, NATCA, and many other airlines and airports that have seen the value of this collaboration. Since its inception, classes have been expanded to other airlines flying into KCLT and attendees have included training check airmen, airline pilots, corporate pilots, medical crews, and dispatchers.

The combined training sessions revealed many areas where significant misunderstandings existed. In many cases, controllers had wide varying levels of knowledge of aircraft performance and stabilized approach criteria and requirements. Issues, such as, rate of turn, rates of descent while slowing, maximum acceptable speed of the final approach fix, and approach stabilization were discussed at length. Other topics included radio navigation capabilities and cockpit workload ramifications during last minute runway changes, especially in highly automated aircraft.

Flight crews were found to be lacking in their understanding of airspace limitations, the importance of using proper phraseology, the use of call sign on clearance readback, and the impact on controller workload when they are unable to comply with a request and do not give adequate notification.

The combined training sessions revealed many areas where significant misunderstandings existed. In many cases, controllers had widely varying levels of knowledge of aircraft performance and stabilized approach criteria and requirements. Issues such as rate of turn, rates of descent while slowing, maximum acceptable speed to the FAF, and approach stabilization were discussed at length. Other topics included RNAV capabilities and cockpit workload ramifications during last minute runway

changes, especially in highly automated aircraft.

Flight crews were found to be lacking in their understanding of airspace limitations, the importance of using proper phraseology, the use of call sign on clearance readback, and the effect on controller workload when failing to provide adequate notification when deviating for weather, or when unable to comply with an ATC clearance.

These efforts have produced dramatic results, but also revealed areas where much improvement is needed. The most impressive result has been the significant reduction in go-arounds at KCLT. Since this program began, go-arounds have decreased 21% while the volume of air traffic increased 10%. Much of this reduction is due to air traffic controllers at KCLT developing a better understanding of the performance characteristics of the B737. Operational errors involving communication discrepancies have also been reduced and this initiative contributed to the successful modification of an ILS to runway 23 and the development of additional training programs.

In addition, US Airways has reported significant savings from reduced fuel consumption due to fewer go-arounds. Customer satisfaction has also been positively affected through more efficient landings on runway 23 at KCLT. This program has opened up channels of communication between the US Airways pilots and the KCLT controllers. In 2000, US Airways pilots and KCLT controllers jointly produced a video that addressed some of the unique performance characteristics of the new Airbus aircraft. This video was distributed to all ATC facilities where US Airways' Airbus aircraft operate.

One of the major keys to the success of this program has been the wide support of all parties involved. The unions, management, and employees all had a common interest in supporting this collaborative effort and all parties have benefited from it. Both safety and operational efficiency have improved and future problems are much more likely to be either resolved quickly or avoided altogether because of the open channels of communication and the spirit of cooperation that has been developed.

Contacts: Jeffrey Solomon, Air Traffic Control Specialist, NATCA, Jeffrey.Solomon@faa.gov; Thomas Denny, Charlotte Air Traffic Manager, 704-359-1000, Thomas.Denny@faa.gov; Al Garin, Check Airman, Airbus 330, US Airways, 704-846-2704, agarin1945@aol.com; and, John Duncan, ALPA Safety Representative, US Airways, 704-553-8251, jcduncan@carolina.rr.com

4.0 "Where Do We Go From Here?"

4.1 Need to Institutionalize Enhanced Pilot/Controller Collaboration

The solutions presented in Section 3.0 to prevent the misconceptions between pilots and controllers outlined in Section 2.0 will only be successful if they are systematically and consistently applied within the pilot and controller communities. In other words, these solutions and others to be determined, need to be included in all aspects of pilot and controller education and training and monitored over time in the same way that other pilot and controller performance requirements are taught, trained, and monitored. This will result in institutionalizing enhanced pilot/controller collaboration.

4.2 Development of Pilot/Controller Collaboration Education, Training and Monitoring Programs

Since any new pilot/controller education, training and monitoring program will be a cost add-on to flight/ATC operations, it is necessary to develop these programs in as cost-effective a manner as possible. Although there are some significant variations from organization to organization due to differences in organizational culture and available resources, it is possible to identify requirements for minimum acceptable pilot/controller collaboration education, training and monitoring programs that each organization could implement. Each organization would be expected to adopt these "core" requirements and introduce other aspects into the programs that meet their specific needs.

In order to obtain a cross-section of views for establishing and implementing minimum acceptable pilot/controller collaboration education, training, and monitoring programs, it is recommended that WG E sponsor a 2-day workshop inviting "active" pilots and controllers to participate in developing various approaches that could be followed to provide cost-effective pilot/controller collaboration programs. Government and industry management representatives would be invited the second day to listen and give their comments on the various approaches that were developed the previous day. At the end of the 2-day session, the most cost-effective of these approaches would be selected for pilots and controllers to use to recommend to their organizations for implementation.

4.3 Implementation of Pilot/Controller Collaboration Education, Training and Monitoring Programs

The only way that pilot/controller collaboration education, training and monitoring programs can be effectively implemented and maintained is if hi-level management emphasis and organizational/funding resources are applied to these programs. To do this, the recommended approaches addressed above need to be brought to the attention of the decision makers within each pilot and controller organization and an implementation process needs to be coordinated. The government's responsibility would be to insure that these programs are established and implemented in the same way that other pilot and controller performance education, training, and monitoring programs are established and implemented. This would include publishing the necessary guidelines and insuring that the guidelines are being applied. Regulatory organizations including ICAO, could also incorporate the recommended approaches into their guidelines for establishing and maintaining a safety management system (SMS).

Appendix A: Sample Course Material Forms & Quizzes

Sample 2: ATC (RESAFE) Module for Airline Pilots, Charlotte Air Traffic Control (courtesy Jeffrey Solomon)

AIR TRAFFIC CONTROL FAMILIARIZATION MODULE FOR AIRLINE PILOTS

Objective: Provide a basic understanding of how the National Airspace System (NAS) operates.
Provide an overview of an Air Traffic Controller's basic job tasks.
Provide a brief description of the National Traffic Management System.
Identify operational issues that are problematic to specific airports/hub facilities.
Goal: Improve safety and efficiency of aircraft operations through enhanced awareness of capabilities and limitations of National Airspace System.
Time: 1:00
Training Aids: Overhead Projector and screen (PowerPoint capable), FAA name tents. Marking pens.
Prerequisites: None
Homework: None
Proficiency: Pass multiple choice examination on ATC knowledge with score of at least 80%.
Instructor Prep: Ensure classroom set-up. Name tents on table.

LESSON

I. INTRODUCTION (10 MINUTES)
- A. Pass out pre-test, allow students to take, then collect papers.
- B. Introduce yourself.
- C. Have class introduce themselves.
- D. Explain: We have a wonderful opportunity to share with you information, which will greatly enhance the efficiency and cooperation between Airline pilots and ATC. This class is a prototype for one which we anticipate providing to all Airline Pilots in the USA.
- E. Emphasize Consequences of lack of knowledge of ATC issues: Play cassette tapes of *errors/incidents. Display plot of operational error and discuss potential consequences.*
- F. Overview: Review National Airspace System and how it interfaces with pilots. Then discuss the actual job tasks that controllers perform to separate and sequence aircraft both on ground movement areas and when airborne. Explain to class that we will conclude with a discussion on operational issues of concern at a major HUB airport. (CLT).
- G. Ground Rules
    1. Discussions are two-way. Intense involvement and questioning of instructor is desired, as well as exchange of personal experiences.
    2. Everyone needs to get involved.

II. NATIONAL AIRSPACE SYSTEM (12 MINUTES)
1. Describe how flights transition through the NAS. Explain why it is necessary for controllers to have a published/printed flight plan/flight progress strip. Review with class the differences in flight management capabilities in Centers vs. Terminals. Discuss in detail how reroutes and altitude changes require manual controller input

into NAS computer. Relate this to class in respect to weather-related deviations and how this "slows down" system.

2. Describe a "data block" and how one is generated (discrete beacon codes). Explain how being within radar coverage of a controller's radar screen does not necessarily mean "radar contact".
3. Describe tower operations, in particular required coordination between ground and local controllers.
4. Describe why "direct" routings are not often possible.
5. Explain that Air Traffic Controllers do not have the authority to "close" an airport. Explain how this fact relates to the pilots' ultimate decision to takeoff or land in inclement conditions.
6. Relate to pilots that an Air Traffic Controller's primary responsibility is the separation of aircraft.
7. Discuss types of approaches issued to pilots and responsibilities of controllers and pilots in regard to conducting these approaches.
    A. Simultaneous/Staggered ILS Approaches
    B. Visual Approaches
8. Speed Control: What are the controller's reasons for issuing speed control (spacing) versus the pilot's understanding of speed adjustments (aircraft configuration)? Emphasize impact of pilot initiated speed changes on controller.
9. Rate of Turn; Controllers base separation and sequencing by anticipating that aircraft will conduct a standard rate of turn (3 degrees per second).
10. Explain why querying a controller as to "sequence" is not useful. Recommend question such as "when can I expect a base turn?" or "how long is the final?"
11. Describe separation standards for turbojets departing vs. arriving aircraft and vice-versa (6000' and airborne rule).
12. Intersection departures are intersection departures; explain implications of back-taxiing.
13. Suggest include in pilot/co-pilot landing and takeoff briefings whether or not runway to be used is also utilized by departing/landing traffic.
14. Ask pilots if they realize that some traffic advisories are mandatory (merging target procedures).
15. Inform pilots as to limitations of "visual separation".

III. COMMUNICATIONS (10 MINUTES)

1. What is standard phraseology?
2. What are the implications of reading or not reading back an ATC clearance?
3. What do controllers mean when they transmit "…say again, I was on the landline"?
4. Clarify to pilots that timely frequency changes are essential. During simultaneous ILS approaches, separation is dependent upon aircraft being on the correct frequency. (Explain).
5. Explain that controllers often work more than one frequency at a time, and how this situation leads to "blocked" transmissions, etc.
6. Discuss "Lifeguard" issue and how ATC is required to handle.
7. Contact ground control prior to taxiing after runway exiting, unless otherwise directed.

8. Ask pilots to describe their perception of what controllers' responsibilities are in regard to ATIS.
9. Emphasize importance of assertive and timely questioning of clearances which appear inappropriate.

IV. HUB-SPECIFIC ISSUES - Charlotte/Douglas International Airport (10 MINUTES)

1. Describe Charlotte's "Runway 5" operation with particular emphasis on why "bottleneck" may only be a perception, and LAHSO requirements.
2. Explain how Charlotte departures and airspace is managed on an "East-West" split. Relate how eastbound jets needing a west runway cause delays.
3. Describe how not having "numbers" causes delays for all traffic due to taxiway configuration at Charlotte.
4. In emergencies, ATC needs to know 1) Type of emergency, and 2) Pilots intentions. Fuel and souls on board is secondary.
5. Describe how exiting runway 36R on C11 is preferable to exiting on taxiway "M".
6. Review in detail the simultaneous ILS operation at Charlotte, with emphasis on expeditious descent to 3600, as well as prompt frequency change to tower when directed.
7. Review simultaneous visual approach operation at Charlotte, and emphasize implication of "overshooting" final approach course.
8. Review with class the fact that the west runway at Charlotte has one of the highest utilization rates in the U.S., due to the fact that it is used for both takeoffs and landings during a "complex".
9. Review with class the reason taxiway "M" cannot be used as an inbound taxiway on a south operation.
10. Emphasize with class the importance of calling ON spot, not enroute to spot to avoid confusion.
11. Discuss with pilots the importance of reading all pages of PDC, particularly in regard to delay information.

V. QUESTION AND ANSWER SESSION AND END OF COURSE TEST (15 MINUTES)
Administer course critique. (3 MINUTES)

THANK CLASS FOR PARTICIPATION.

RESAFE Pre-test

Circle the best answer.

1. Air Traffic Controllers assign speed control to aircraft established on the final approach course:

    a. in order to permit the pilot to configure the aircraft for landing.
    b. in order to provide in-trail separation between aircraft.
    c. to provide the pilot with a stabilized approach.
    d. to minimize wake turbulence.
    e. all of the above.

2. When cleared for a "visual approach" at RDU, GSO, or CLT, the pilot is responsible for:

    a. separation from other aircraft only.
    b. separation from terrain, obstructions, and all other aircraft.
    c. separation from terrain and obstructions only.
    d. none of the above.

3. Once communication has been established with ATC:

    a. the controller need not restate the facility identification.
    b. the pilot need not restate the aircraft's call sign (provided voice recognition is accomplished).
    c. The controller and pilot must both restate their identification with each transmission.
    d. Only altitude assignments must be readback unless otherwise directed.

4. You are conducting the ILS Runway 36L approach at Charlotte Airport, in the event you elect to commence a "missed approach", you can expect to fly the published missed approach procedure.

    a. True
    b. False

5. When simultaneous ILS approaches are being conducted at the Charlotte Airport or at the Pittsburgh Airport, heavy jet traffic established on one localizer are permitted to overtake traffic established on the adjacent localizer.

    a. True
    b. False

6. When simultaneous ILS approaches are being conducted at the Charlotte Airport, at least 1000 feet vertical separation must be provided between two aircraft within 3 miles of each other until both aircraft are established on adjacent localizers.

    a. True
    b. False

7. Controllers separate IFR aircraft vertically in the terminal environment:

    a. by 1000 feet between large aircraft, 1500 feet when a heavy aircraft is involved, and 500 feet when a small aircraft is involved.
    b. by 2000 feet between aircraft.
    c. by 500 feet between aircraft.
    d. by 1000 feet between aircraft.

8. During VFR conditions, once the ground controller determines there are no arriving or departing traffic, the ground controller need <u>not</u> verbally coordinate with the tower controller prior to authorizing an aircraft to cross a runway.

    a. True
    b. False
    c. True, however the ground controller may <u>not</u> cross in front of an aircraft holding in takeoff position without verbal coordination with the tower controller.

9. Controllers may substitute improvised phraseology for standard phraseology:

    a. With the condition that it is clearly understood by the pilot.
    b. When it is an established custom at that particular facility.
    c. When the controller deems it appropriate.
    d. Never.

10. A controller may authorize a pilot to deviate from his/her assigned routing:

    a. As long as the aircraft is and will remain in the controller's airspace.
    b. Only if the aircraft is within radar coverage of all affected controllers.
    c. As long as the controller can visually determine that there is no conflict with other aircraft.
    d. None of the above.

11. A severe (Level 5) thunderstorm erupts at the Raleigh/Durham Airport. You are inbound for landing. Most likely, the RDU tower controller will:

    a. Clear you to land.
    b. Close the airport and issue a NOTAM.
    c. Close the airport, but not issue a NOTAM.
    d. Advise pilots that takeoffs and landings are "at pilot's own risk".

12. When reading back a clearance to ATC, the correct pronunciation of the numbers "9, 5, 3" is:

    a. "niner, fife, tree".
    b. "nine, five, three".
    c. "niner, five, three".
    d. "nine, phi, three".

(Answers: b,c,a,b,a,a,d,b,d,a,a,a)

Sample 2: "Structured Interaction for Controller Flights on Board Mas Air" (Courtesy Capt. Andres Fabre, Mas Air)

This program invites air traffic controllers to ride jumpseat in Mas Air aircraft. It is a very structured effort, not designed primarily as a travel benefit for controllers, but rather for effective learning about the cockpit environment. A series of topics are designated that must be talked about during the flight (see below). Interaction between the pilots and the jumpseating controller should take place in flight during the cruise phase, as the workload permits. Each of the points on this list should be covered, giving information and asking questions, seeking to create an interaction with the goal of understanding procedures and the needs of the other party.

Aircraft
• Functioning of the *FMC* in general ☑ Navigation, direct-to authorizations ☑ Changes in route ☑ Late changes of runway prior to takeoff and the deletion of takeoff speeds
• Speeds in general (take-off, clean aircraft, climb, cruise, descent and approach)
• Limitations on the approach (crosswind and tailwind components, dry runway, wet runway, etc.)
• Time for deceleration ☑ Light or heavy aircraft ☑ Configuration
• Difficulty in maneuvers for "reducing and descending" without prior warning ☑ LAX and MEX arrival with vectors examples
OTHER TOPICS REGARDING CHARACTERISTICS OF THE AIRCRAFT
ATC Procedures
• Direct flights en route or approach ☑ Conditions for authorizing them or not
• Speed restrictions (reasons for …) ☑ Departure or arrival ☑ Special authorizations
• Dumping fuel ☑ Convenient areas ☑ Holding pattern or straight line?
• General procedures for entering/departing the MEX area ☑ Vectors, shortened approaches ☑ Specific speeds ☑ Anticipated ATC information to the pilot ("stand by for possible vectors ...")
• Procedures in case of a flight emergency ☑ Advises to other dependencies

☑ ATC actions and consequences of a “mayday” declaration vs. no declaration, etc.
• Emergency ATC procedures when there is a Dangerous Goods warning ☑ ATC action ☑ Required information and its retransmission ☑ Assistance offered, etc.
• Minimum separation on takeoff for wake turbulence
• Considerations for takeoff/landing sequences ☑ Push-back authorizations with someone taxiing to that point ☑ Why an airplane takes off before another ahead on taxiway “B” (route, type of departure, delays on taxiing) ☑ How approach sequence is generated on Approach Control (altitude, speed, distance, type of aircraft)
• Instructions to “position and hold” ☑ Limitations of time holding at the runway ☑ Procedures to avoid runway incursion
OTHER ATC PROCEDURES
Flight Procedures
• Management of vectoring with the *FMC* and *MCP*
• Difference in flying “radials” vs to a “fix” (interception of radials)
• Established taxi speeds ☑ Possibility of expediting 767 taxi to expedite takeoff
• Actions with TCAS RA ☑ Priority of RA over ATC instruction ☑ Experiences and familiarization with TCAS
• Escape route with engine failure at MEX and GDL
• Consequences of shortened approaches or late runway changes without prior warning
• Maximum speeds on IAF by regulation and *ALAR* recommendation ☑ Case of 160Kts on Mateo VOR
• General information about Dangerous Goods ☑ Common types transported (examples) ☑ Necessary information for the crew (NOTOC) ☑ Required assistance ☑ On board DG Kit, etc.
• Management of EMERGENCIES in various phases of flight ☑ Required assistance on the part of ATC ☑ Seriousness and consequences of each type ☑ Actions by the crew • Note: analyze for depressurization, hydraulic failure, engine failure, fire, smoke in the cabin, navigation equipment failure and others.
• Procedures established by Mas Air for preventing runway incursions
OTHER FLIGHT PROCEDURES

Appendix B: Survey Form for Pilots

The Global Aviation Information Network (GAIN), an industry-led initiative promoting the sharing of information to improve aviation safety, is surveying pilots on topics that they would like to see emphasized in controller training/education courses. Please complete the questions below (all or just some of them), using additional pieces of paper if desired. Completed forms can be emailed to pmoylan@rsis.com or faxed to +1 (202) 267-5234. You will receive feedback and a copy of the report that your answers below will help us to create.

1. What do you wish controllers understood better about your job?

2. What Misconceptions do you think controllers have about the flying profession in general?

3. If you could have one hour in every controller's training class, what would you talk about?

4. If a controller spent a days worth of flights with you, what do you think the controller would learn that he or she probably did not know?

5. What specific piloting-related topics do you think should be included and/or emphasized in ATC training and education courses? *(Examples of previous responses have included topics such as effects of automation (particularly during approach and landing), pressures to minimize noise abatement and fuel consumption, cockpit environment during aircraft emergencies and extreme weather, stabilized approach criteria and requirements, effects of runway changes during approach, etc.)*

6. Can someone from GAIN contact you about your responses? If so, please list you name and contact information (phone and email):

THANK YOU! If you have any questions about GAIN or this survey, please visit www.gainweb.org, or feel free to contact Patrick Moylan at +1 (202) 267-9740 or by email at pmoylan@rsis.com.

Appendix B (cont.): Survey Form for Controllers

The Global Aviation Information Network (GAIN), an industry-led initiative promoting the sharing of information to improve aviation safety, is surveying air traffic controllers on ATC topics that they would like to see emphasized in pilot training/education courses. Please complete the questions below (all or just some of them), using additional pieces of paper if desired. Completed forms can be emailed to pmoylan@rsis.com or faxed to +1 (202) 267-5234. You will receive feedback and a copy of the report that your answers below will help us to create.

1. What do you wish pilots understood better about your job?

2. What Misconceptions do you think pilots have about the ATC system in general?

3. If you could have one hour in every pilot's training class, what would you talk about?

4. If a pilot visited you at your place of work (tower, TRACON, ARTCC, etc.) what would the pilot learn that he or she probably did not know?

5. What specific ATC-related topics do you think should be included and/or emphasized in pilot training and education courses? *(Examples of previous responses have included topics such as standard phraseology, radio technique, separation requirements, frequency limitations, controller workload, airspace limitations, etc.)*

6. Can someone from GAIN contact you about your responses? If so, please list you name and contact information (phone and email):

THANK YOU! If you have any questions about GAIN or this survey, please visit www.gainweb.org, or feel free to contact Patrick Moylan at +1 (202) 267-9740 or by email at pmoylan@rsis.com.

Appendix C: Report Feedback Form

Report Feedback Form

GAIN Working Group E encourages the submittal of any comments and/or suggestions that will improve the content of future issues of this report. Please submit this form to:

GAIN Working Group E
c/o Federal Aviation Administration
800 Independence Ave, SW, Room 738
Washington, DC 20591
USA
Fax: +1 (202) 267-5234

Name: _____

Title/Position: _____

Company _____

Mailing Address: _____

Phone/Fax Number: _____

E-Mail: _____

1) How useful is this report to your organization? *(Please circle one)*

not useful - 1 2 3 4 5 - very useful

Comments: _____

_____

2) What information contained in this report is most useful to your organization?

_____

_____

3) What information would you like to see added to future editions of this report? _____

_____

_____

_____

_____

4) Are you aware of any pilot/controller collaboration initiatives that have been effective in improving safety and/or efficiency?

_____

_____

Please provide any details that you would like to share with WG E regarding these initiatives:

_____

_____

What activities should WG E undertake that would be most useful to you and your organization?

_____

_____

_____

5) Would you or someone in your organization be interested in participating in WG E activities?

YES / NO

6) Would you like to be added to our mailing list? **YES / NO**

Other Comments/Suggestions: _____

_____

_____

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