INTERNATIONAL AVIATION ENGLISH ASSOCIATION

NEWSLETTER

Editor: Will Hope-Ross

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EDITORIAL

Luxembourg Workshop

The workshop entitled Recurrent Training in English for RT was hosted by the Eurocontrol Institute of Air Navigation in Luxembourg and was very well attended. As ever, the allotted time seemed all too short. However a lot was packed into a day and a half.

Jeremy Mell and Carmel Godmet informed us about the considerable efforts being made in France by the Direction Générale de l'Aviation Civile (the French Civil Aviation Authority) to have a proper theoretical and practical basis behind recurrent training for Air Traffic Controllers. For those conversant with applied linguistics, is was fascinating to see the application of communicative techniques of analysis to the language of RT. It also gave an insight into how carefully language training programmes are constructed. The workshop session on the second day allowed all present to put theory into practice as well as giving the language instructors some useful ideas for classroom exercises. We are now better equipped to write a communicative syllabus for English for RT.

The update given by John Rose on the activities of the Eurocontrol Institute of Air Navigation (eg. the PHARE programme and the PELA tests) served to emphasise how much can be done once the authorities with the purse strings are convinced of the need for language testing and training.

The difference between the programme for cadets in basic training whom Mirna Marincic takes under her wing at the University of Zagreb in Croatia, and the retraining sessions for those who dare to backslide was explained with verve by Mirna, and Violeta Aldea of Romatsa (Romanian Air Traffic Services) read us an impeccable paper on responsibility for recurrent English training. The ensuing discussion, ably chaired by Tony Roome, of CAA UK, could have profitably been extended for an hour or two, though

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IN THIS ISSUE

WHOSE RESPONSIBILITY IS RECURRENT ENGLISH R/T?

Violeta Aldea.

Expert in Aeronautical English, Air Navigation Services Division, ROMATSA, Romania

We are trying to establish **whose responsibility English R/T recurrent training should be.** Should this be the charge of English teachers or senior ATCOs?

As far as I know, there are countries where ATC trainees, during their ab initio training, learn or review their General English knowledge, to generally achieve a pre-intermediate or intermediate level of English. When they are considered to be fully conversant, they attend a course in English R/T, usually with a senior ATCO, who , at the same time, demonstrates the traffic situations where this phraseology is to be used. That was the situation in my country as well, when I was employed at the Aeronautical Staff Training Centre in Bucharest. I will tell you about the circumstances that led my colleagues and me to the conclusion that not only ab initio English R/T training but also recurrent English R/T training should be the responsibility of English teachers, within formal refresher courses. This may not be the case in countries where ATC instructors are native English speakers but it is certainly the case in countries where students have to learn English as a foreign language and then use it as a relevant part of their routine and non-routine jobs. When we started teach-

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EDITORIAL (contd.)

perhaps it was better to stop when we did as we seemed to be about to try to take ICAO by storm.

We were privileged to have an opportunity to see the last thing in technological progress in language training with Harland Goertz' presentation of Skytalk - a speech recognition training programme for pilots and ATCO's.

The people present at this workshop displayed such an amount of energy and desire to see improvements in the theory and practice of English radiotelephony that it was decided to form a sub-group of the Association working towards such a goal. Jeremy Mell agreed to lead the Radiotelephony Quality Group which will have its first meeting during the Riga Seminar in September.

All of this would not have been possible without the cooperation and assistance of our hosts from the Eurocontrol Institute of Air Navigation. We were lucky indeed to have their conference room with such wonderful acoustics so that our relatively large group could work without microphones. The Association wishes to thank the Director, Mr. Loosbroek, for extending the hospitality of the Institute to the Association, and for taking time to welcome us in person. We would also like to thank Mr. Decarnière who was the link man between Luxembourg and Paris, and Mme Vanhoven who took care of the organisational side of things.

We are particularly grateful to Carmel Godmet and Jeremy Mell who masterfully dealt with the major part of the programme.

The degree of commitment and professionalism that people bring to our events is always impressive. I am sure it helps tremendously to know that one is not a lone voice crying in the wilderness for better English communications in aviation and that there is a solid core of people working in the same direction.

A seminar was held in Riga, Latvia in September on the topic of initial training in RT. A report of the proceedings will appear in the next edition of the Newsletter. The next event to be held in Brazil on the topic of Cabin and Cockpit Announcements, was initially planned for early December, but has been postponed. The new date will be announced later.

April in Paris!

A Forum in Paris is at the early planning stages. We are working with dates around April 24rd, 1997. Details will be mailed whenever they are confirmed, but we thought you would like to have advanced notice.■

Fiona A. Robertson

Whose Responsibility is Recurrent English R/T (contd.)

ing English for ATCOs, my colleagues and I found out that there was an urgent need for ATC trainees to have "tailored courses", as the conversation in class invariably used to switch to aviation problems, unusual traffic situations, traffic conflicts of all kinds and cases of English R/T misuse. During the "peak" traffic periods, in summer, there weren't usually too many courses to run, so we asked our management team to provide us with some sort of familiarisation with aviation facts and air traffic control. We started by learning a bit of navigation with specialists in the field then about the ATC structure and the responsibilities of each ATC unit. The fact that we were also teaching English for pilots helped us a lot, as we could consider things from both angles, from a pilot's and an air traffic controller's. At that time there was an ICAO senior ATC instructor at Bucharest-Otopeni International Airport whose charge was to instruct Romanian controllers on the use of a Thomson Secondary Surveillance Radar that had been purchased for Bucharest ACC. To his credit, he initiated a three weeks course for the English teachers of the Aeronautical Staff Training Centre. He started by teaching us the configuration of the Romanian airspace and how to control aircraft in Bucharest ACC, of course, at the Thomson traffic simulator. It wasn't easy at all. For two weeks we did our best to control aircraft en route and coordinate with adjacent ACCS. The "dummy pilots" in the next room enjoyed themselves a lot hearing their teachers during their "on-the-job training". We found out that, while working under stress, we frequently made language mistakes ourselves, though we had learned the RT phrases by heart. To cut the story short, my colleagues and I realised that, to make the best use of the radiotelephony phrases, they had to be learned and practised until they could be used automatically, without conscious thought. Following that extremely useful experience our lessons became more credible. Our trainees perceived classes as team work, in which we all, teachers and students, were trying to debate traffic situations, make suggestions, comment on some English R/T mistakes pilots usually made during the two way communication (as pilots do not always stick to the R/T standard phrases).

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Goodbye ed.

With this edition of the Newsletter, we regretfully say goodbye to our editor, Philip Shawcross, who has so carefully and skilfully built the publication from scratch. For the Association to exist, it must have a voice and we must thank Philip for giving the voice not only its professional polish but also its sparkle. I am sure I speak for all our members when I say that we appreciate enormously the amount of care and time that went into each edition. Philip is also one of the two founder members of the Association, so without him there would have been neither Association nor Newsletter. We hasten, therefore, to tell you that he will remain a mainstay of the Association.

Hello ed.

Sad though it is to close the first chapter of the Newsletter's life, we are very happy to be able to welcome the editor of this edition William Hope-Ross who works as English Training Manager in the Czech Airlines. We recognize that it is no small undertaking and are very grateful to him for stepping in, thus making a seamless transition.

Whose Responsibility is Recurrent English R/T *(contd.)*

Students were talking in English about professional facts they were interested in, without being fully aware that they were using their general English knowledge previously acquired.

Why should English teachers design English R/T refresher courses?

R/T phraseology consists of a list of standard phrases, under appropriate headings, from which ATCOs are to compose the text of their messages, according to the requirements laid down for a particular procedure. These messages should not contain more than three specific phrases, and be comprised of: a clearance, instructions or pertinent information. In case of doubt (for instance, a foreign pilot having difficulty with the English language or an inexperienced pilot unsure of the procedures), the number of items should be reduced and if necessary passed, and acknowledged, singly. Messages should not contain private items, unnecessary information or courtesies. However, these lists are not exhaustive and controllers may have to devise additional phrases for unusual situations, where there are no set phrases for particular purposes.

In Romania, English is the compulsory language in which ATCOs have to control IFR aircraft and do the whole coordination work. General and R/T English use in conducting communications comes to add to the stress implied by other tasks controllers have to cope with: to maintain situational awareness, make decisions for control action, provide separation, provide pilots with relevant information, provide assistance to aircraft in abnormal situations and provide tactical Air Traffic Management.

Much in the same way as controllers may be granted familiarisation flights in the cockpit of aircraft or at flight simulators, **R/T English teachers, in my opinion, should get familiar with the ATC structure and ATCOs' job description.** Simple as it might appear, this codified aviation language implies a lot of explanations when being taught to ATC trainees, as they are not children to take things as such. With recurrent English R/T training, though teachers do not have to teach students the micro-relationship between R/T phrases and the situations they apply to (as students know it already), they may explain grammatical features which frequently confuse the students.

Simulator work alone leaves no time for brushing up English knowledge. With English R/T training, basically there are two types of lessons. They are the knowledge lesson and the skill lesson. Both have similar structures, involving a clear beginning (called an introduction), a middle (development) and an end (consolidation).

In an ATC simulator 60 % of the time allotted to a lesson is devoted to guided individual practice, the rest being reserved for explanation, demonstration and imitation.

In the knowledge lessons which we, English teachers, do in a more or less formal classroom environment, **time can be managed according to our trainees' needs.** Recurrent R/T training, as compared to the ab initio training, implies more difficulties for a teacher. Lessons should be related to the trainees' prior knowledge or experience. In the review-type introduction of each lesson, we have to discover how much of our students' R/T knowledge has entered their passive vocabulary. Such introductions help demonstrate how relevant the chosen subjects are and how important they are to the group of trainees. Each refresher course has to be tailored accordingly and students help us develop the themes and objectives of the sessions. We then have to sequence our teaching points into chunks of information, with interim questions. Consolidation activities are the most important parts of our lessons, **to allow students to rehearse or review standard phrases which they have misused or forgotten.**

During the English classes, we can afford to devote as much time as necessary to the **R/T subgrammar,** pointing out where deletions or ellipses are permitted, as one or more phrases may be used in a message, but all items in a phrase are to be included. This semiartificial international language is continuously searching for clarity, precision and lack of ambiguity, which results in a tendency towards ellipsis. Only part of any given message initiated by a pilot or a controller is actually transmitted, but it should be partly sufficient to allow the whole message to be comprehended. To make sure that the message has been completely restored by the receiver with complete integrity, the English teacher should make his trainees paraphrase the R/T phrases. This can be done in a classroom only and the teacher should be aware of his trainees' extralinguistic knowledge of each context.

The language barrier is an important factor in teaching R/T to non-native English speakers: ATCOs have to analyse traffic situations, make decisions and communicate them in a very short time. Trying to translate the English inputs into their mother tongue and back leads to a risk of confusion. That is why, through the exercises we design, adapt or adopt from various books, we aim at having our trainees understand, handle and produce English well enough to deal with a variety of every day traffic situations with relative ease.

There are also a lot of "false friends" even in R/T phrase components, for instance: both "present" and "actual" are translated into Romanian in the same way. The same happens with other groups of words, such as: "acknowledge " and "confirm", "check" and "verify", "cancel" and "disregard", "revert", "resume" and "come back to", "straight-in approach" and "direct approach", "in sight" and "visually" and many others. Through various sets of language drills, trainees may understand the difference in word meanings and use them appropriately.

Context is very important in R/T recurrent training, where the focus shifts from the mere knowledge of R/T phrases to their use in situations. At present, there is not an ideal textbook for ATCOs. All books contain some core modules, addressed to both pilots and controllers. That is why we design tailored courses and use "cut and paste" teaching material, relevant to what we want to review. We find

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Whose Responsibility is Recurrent English R/T *(contd.)*

case studies very useful, whereby the material is posed in the form of a simulated problem, more usually a single paragraph which may elicit suggestions from our students as to what kind of message a controller is supposed to initiate.

The main advantage of a classroom lesson is that **students learn at their own pace,** being given time to recall what they have forgotten and the opportunity to work in pairs and discuss all items of interest. At the same time, **language mistakes,** as they occur, are categorised and **are used as teaching tools.** Unlike in conversational English, where students are not to be interrupted too often, in R/T refresher courses we act on the principle that, at each stage we detect R/T misuse, such mistakes should be corrected as they appear, to prevent their fixation in the students' speech. This is a great help for OJT coaches: during on-the-job training and even at the simulator, few mistakes can be tolerated and then only minor ones. There, the situation does not allow time to "stop clocks" and sort out the problem.

Teaching techniques are different between a classroom environment and the simulator work. During the more formal classroom phase of training, language exercises may be graded so that students may achieve maximum learning benefit. This situation is not entirely possible during OJT or simulator work, as the flow of air traffic cannot be adapted to suit individual student requirements. On the other hand, operational controllers employed on a short term basis as simulator coaches cannot help but consider student's training in terms of the fully qualified controller. In their simulator exercises ATC procedures are often more complicated. Simplified procedures developed in the classroom, as language exercises, with relatively simple air traffic situations, will greatly increase the students' understanding of the correct use of R/T phrases, so that effective application of such phrases can be made to the operational environment with confidence. Sometimes, having a phrase as a start, students discover they have different opinions as to the way they should react to the prompt. Romanian ATCOs are to stick to ICAO phraseologies, so, in case we use a class material which employs other than ICAO standard phrases, we must emphasize the fact that it is good for them to know all possible pilots reactions (especially in unusual situations), **but they should use standard phrases as a response,** to avoid frequencies overload. While controlling, they are also tempted to use General English phrases, like "take the shortcut to...", which are not recommended by the regulations. Likewise, we point out that phrases frequently used by pilots should not be taken for granted, even if they are native English speakers, as pilots do not always stick to the book.

One aspect of R/T recurrent training which should not be neglected is that relating to **emergency and unusual situations,** i.e. aircraft and ATC system malfunctions. The Jeppesen Manual offers some examples of emergency situations, which can be practised in class, during a refresher course. Likewise, overconfidence of a licenced controller, especially that related to the English R/T phraseology, is his greatest enemy. Whatever the ATC environment, controllers should review the published back-up procedures which would be put into operations in the event of a "system failure". **Procedural control phrases should remain fresh in their minds,** whatever sophisticated and advanced automated radar systems they work with. They must be reminded of the limited service that can be provided by a modern computer-generated radar display when such a system is degraded though technical failure. An ATCO may perform his task satisfactorily for many years without ever being faced with an emergency situation and thus not be fully aware of the correct procedures to apply quickly, should such a situation develop. It's impossible to predict every type of emergencies. Still, **situational interviews,** developed in class and conducted in English, review general English knowledge, ICAO procedures and R/T at the same time. They also allow **natural learning,** which operates when a person is involved in using a foreign language for communication.

The lesson method, in a room environment, has the advantage of being extremely flexible. It is suitable to classes of all levels of General and R/T English. The English teacher has a wide range of materials at his/her disposal, some of them designed "on the way", to cover the knowledge gaps he/she discovers while dealing with various R/T chapters and to create effective learning situations.

Lessons may include ingredients of **all main instructional strategies** which are usually employed by conversational English teaching, that is, giving and taking information. The activities proposed can either be designed, selected from existing materials, or adapted. To urge other English teachers to teach R/T, I can tell them that there is a lot of professional satisfaction while doing that: there is a recurrent core vocabulary which can be arranged in as many ways as one's experience in teaching allows to:

- **fill in the blank exercises,** which allow grammar rules review;
- **brainstorms,** appropriate for a lesson introduction;
- word associations, which enable students to quickly cluster words and phrases used in the same area of usage;
- **multiple choice exercises;**
- **grouping words and phrases** according to prompted headlines;
- find the **"odd man out";**
- **jumbled sentences;**
- **role playing,** at the language laboratory, where trainees, in pairs, take turns as the controller and the pilot;
- **situational interview,** which means that ATCOs are asked what they would do and say in a described possible traffic situation and may recount any personal experience they may have had;
- **skim reading,** using fragments of incident reports where misuse of R/T had a bearing and many other instructional strategies that may hold trainees' interest and attention.

Thus, the lesson has a motivating effect, not only from the

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teacher's point ofview, but also from the point of view of the group itself.

R/T recurrent training in a classroom environment also creates among trainees the **experience of cooperating through the English language,** in order to overcome a mutual obstacle, that of resolving difficulties with prelearned standard words and phrases. It also provides a good opportunity for ATCOs from all over the country to know each other. Older generation of controllers usually have a poor grasp of English, though good professionals. The classroom environment is a good and "safe" place for them to learn English and implement R/T amendments, without having their susceptibilities and sense of rank affected. The English teacher must be constantly aware of this situation and be able to deal with the trainees' difficulty to understand. There may be gaps in their knowledge of English grammar. Before passing on to the simulator training such gaps should be eliminated and R/T knowledge updated so as to enable trainees to concentrate on traffic situations only.

I have not mentioned the **correct pronunciation and accentuation of the R/T phrases,** which is the main responsibility of an English teacher. To have trainees acquire a correct pronunciation, audio cassettes may be used, especially those recorded with a sound quality reflecting their work environment.

In Romania, ATCOs usually take refresher courses before their annual licence renewal at the Romanian Civil Aviation Authority. Some ATC tasks can be acquired in a room environment, others can be mastered on the job. As a rule, an English R/T refresher course is followed by a practical session on the simulator, where trainees are given a clear overall assessment. The simulator training is guided by coaches appointed from ROMATSA senior ATCOs and other experts from the Air Navigation Division. **There is close co-operation between these experts and the English teachers,** as training entails team effort. The theory reviewed by the students in class is immediately taken into the simulation. The English teacher assistance reduces the simulator instructor training time, eases the transition from formal to informal (OJT) training and assists students in settling into live traffic situations.

There is also an exchange of information and opinions between all of us involved in training which helps to promote a more thorough approach to recurrent R/T training and possibly in a shorter and more economic time. Our common goal is to develop skills and strategies for using English R/T to communicate meanings as effectively as possible in concrete situations.

As anticipation is the key word in aviation, both coaches and teachers keep a close record of ATCOs' training needs and try to adapt our training methods to each and every situation. The results obtained by our trainees following test administrations and the "check lists" we usually require them to complete at the end of each refresher course help us assess what remains to be done in the future. ■

A needs-related syllabus in recurrent training in English for air traffic controllers

Carmel Godmet & Jeremy Mell

What does a working controller need from recurrent training?

The language needs of air traffic controllers (ATCOs) are largely determined by the requirement to communicate orally with pilots by means of HF and VHF radio channels[1]. To define these needs in broad terms, we need not look further than the performance requirements put forward by Eurocontrol for their own Test in Proficiency in the English Language for Air Traffic Controllers (PELA). Although this test has been designed for trainees finishing their basic training, we consider that the overall objectives set standards that need to be maintained throughout a working lifetime, and are thus applicable to recurrent training. The test documentation[(1)] requires successful candidates to demonstrate the ability to:

a) adhere strictly to published ICAO phraseology when giving and requesting information, giving instructions (and clearances) and producing other communications with pilots (or other controllers) in standard ATC situations.

b) display the ability to produce messages in natural language in common situations which necessitate departure from ICAO phraseology.

c) demonstrate the ability to produce intelligible messages for pilots in unusual or abnormal ATC situations which require a greater linguistic ability than in a) and b) above.

d) demonstrate the ability to produce a clear, concise and unambiguous use of natural language, even under stress, when ICAO phraseology cannot adequately serve a transmission.

e) understand and make the appropriate linguistic response to a message transmitted by a pilot using either published ICAO phraseology or natural language.

f) resolve misunderstandings in communication due to:

- *the limited language competency of the transmitter (pilot/controller)*
- *noise and/or other distortion, e.g. accent of speaker*
- *stress induced situation*

g) demonstrate an effective use of natural language so as to manage the pilot/controller and controller/controller relationship, e.g. problem solving, reprimand, reassurance etc.

Among the important conclusions to be drawn from the above specifications is that radiotelephony communications cannot be limited to the correct use of phraseology. The references to *"natural language", "departure from ICAO phraseology"* etc. reflect an operational reality in which official phraseology does indeed play a central role, but

[1] Other professional tasks involving the use of spoken or written language were not the concern of this workshop.

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A needs-related syllabus in recurrent training in English for air traffic controllers *(contd.)*

in which speakers cannot carry out their designated tasks without calling on the resources of a wider range of language - and this is of major import to the content, staffing and cost of any language training programme[2].

The context of recurrent training in France

Factors of difficulty

Controllers are dispersed nationwide, working on facilities of varying size and importance - from ACC employing up to 370 controllers to small aerodromes with six or seven controllers. Levels of proficiency vary greatly within facilities and from one facility to another. This is mainly due to recent changes in recruitment and basic training which have involved increased emphasis on English language training. Other major divergences in level are often due to the civil service policy of internal promotion and spot recruitment of ex-military staff. These varying levels of proficiency give rise to a variety of objectives (eg. attaining, maintaining or "topping up" a level), all of which must be satisfied within a recurrent training programme.

Levels of learning ability too vary greatly. The relatively advanced average age in many facilities is a drawback leading to declining learning abilities and lost learning strategies. Negative attitudes to English due to previous negative learning experiences are a further drawback often strengthened by a minimalist, "survival" approach to language needs, particularly in the smaller aerodromes where traffic in English is infrequent. Motivation is a major factor of difficulty in this type of situation. Low motivation is not compensated for by the fact that participation in recurrent English language training is almost exclusively on a voluntary basis. In addition, irregular hours on the site lead to attendance difficulties even for the more motivated.

The absence of professional obligation, along with controllers' over-familiarity with the subject matter and with a lot of the training materials available, places the onus on the trainer to make his/her course content as attractive as possible in order to ensure maximum participation. Constant renewal both of material and methodology is essential because of the relatively stable nature of the controller population within each facility.

As in the majority of cases trainers do not belong to a training establishment, problems of status arise which ultimately affect their credibility on site. Credibility can be further affected by the limited extent of their ATC experience and limited access to recurrent training of their own.

Positive factors

Carmel Godmet

In a recurrent training situation, the controller's individual professional experience has an important role to play. The teacher-learner relationship is a cooperative one, and training is learner-centred, with the experienced controller as a major source of learning input in the form of anecdotes and professional expertise. The professional controller is usually very much aware of the importance of English in his/her work and often has a relatively clear idea of his performance needs.

Irregular hours on site of both controllers and language trainers (especially in smaller facilities) give rise to a variety of training strategies tailored to suit local facilities and training capacities. The following solutions being operated at present:

- distance learning course run from the ENAC
- telephone lessons by local trainers
- immersion course (UK and Ireland)
- residential courses in France
- forms of learner autonomy (self-access centres)
- one-to-one instruction on site
- 2, 3 or 5-day group courses on site
- on-the-job training (real-time monitoring of the controller's R/T performance with subsequent feedback)

Moreover, because of the nature of their job and their contacts with airline companies, all French controllers have access to economical, and sometimes free, air travel. For those who avail themselves of it, foreign travel, and the opportunities it affords to speak English outside the professional sphere, can be a motivating force.

Finally, the voluntary nature of English language training, cited above as a negative factor, also, paradoxically, has a positive impact in that controllers who attend courses on this basis do so whole-heartedly and are extremely motivated. Hence they are particularly receptive learners.

Developing a national strategy

Until recently therefore no national strategy for recurrent training had been defined and this led to the kaleidoscope of training strategies mentioned above.

[2] During discussions that followed this presentation it proved difficult to arrive at a consensus on the distinctions to be drawn between the terms «radiotelephony» and «phraseology». For the authors, the term «radiotelephony» (or R/T) denotes a means of spoken communication regardless of the actual language used. «Phraseology» on the other hand denotes one part -the part that is prescribed by ICAO and other competent aviation authorities - of the actual language content of conversations conducted via R/T. While it is true that many professionals tend to assimilate the meaning of «radiotelephony» to that of «phraseology» as we have defined it above, the distinction we have made is fundamental to a clear analysis of the training issues involved and is moreover supported implicitly in recognised training materials such as (2) and (3).

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A needs-related syllabus in recurrent training in English for air traffic controllers *(contd.)*

This state of affairs was recognised by the national authority (DNA) in the early nineties and a working group was set up under their auspices in 1994 with a brief to put forward proposals for an organisational and pedagogical strategy. The members of the group included working air traffic controllers, local language trainers and representatives from the ENAC and DNA. The final report, which was delivered in March 1995, comprised recommendations concerning the training objectives in terms of the required level of English to be attained, the organisation on a regional basis of training resources, standardised conditions of employment for language trainers and a language reference document (4) defining syllabus content.

Considerations in syllabus planning

The principal options available for this - as for many - professional language training strategies can be either to go for a narrowly job-specific approach, where language is presented and practised exclusively in professional situations familiar to the trainees, or to opt for a broader coverage of language or language skills by providing courses in «general» English catering for social uses of the language, cultural interests of the trainees, etc.

The obvious advantage of the first option is that it guarantees the relevance of language training to professional requirements. The associated risk, however, is that over the extended time span of recurrent training (up to 30 years for a given individual) courses will become repetitive and therefore demotivating. While the second option may solve the problem of motivation and ease the trainer's quest for interesting learning materials, it runs the risk of sinning on the side of irrelevance and time wasted with regard to professional requirements.

The language reference document which finally emerged from the French working group was the result of a conscious and deliberate choice to chart a middle course between these two extremes so as to ensure that course content will always be needs-related even if it is not job-specific.

The language reference document

The aim of this document is to provide a checklist from which trainers can select elements for a specific training course or evaluate the suitability of training materials[3]. It is equally intended as a tool for managers to brief outside training organisations as to the professional English needs to be incorporated in courses they run. The promise, made above, that the relevance of training courses can thus be ensured, can be kept thanks to the multiple levels on which language operates. The three levels selected for training in English for R/T are lexical domains, communicative functions and interactive modes. If a given training option reflects professional uses of language on all three of these levels it will be overtly job-specific (eg. listening comprehension practice using authentic recordings of R/T communications or language laboratory exercises simulating pilot-controller exchanges). On the other hand, if it reflects professional uses of language on at least one of these levels, we argue that it will still be demonstrably contributing to the professional requirements of the course.

In the list below we summarise the principal characteristics and sub-categories of each of these levels for easy reference. Following that, we will describe each level in greater detail and its effect on course content and materials.

1. Lexical domains and sub-domains (related to ATC **events**)

   Subcategories:
   - aerodrome control
   - en route control
   - domains common to aerodrome and en route control

2. Communicative functions (related to ATC **tasks**)

   Subcategoires:
   - triggering actions
   - sharing information
   - managing the relation
   - managing the dialogue

3. Interactive modes (related to the ATC **environment**)

   Subcategories:
   - cognition
   - reception
   - production
   - relation

Inventory 1: lexical domains

This inventory is the most overtly needs-driven element of the proposed syllabus. It is a list of «events» or real control situations and the «domains» or topic areas which they generate. The vocabulary that can be tied to each of these domains (or sub-domains) makes up the lexical core of the syllabus.

This inventory is the fruit of empirical job-specific training experience and applied linguistics research of its authors and their colleagues as well as an extended consultative phase during working group meetings where experienced controllers validated and enriched the inventory with reference to their professional experience.

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[3] An illustrious precursor to this document, and a source of inspiration over many years of language teaching and course design, has been the Council of Europe's Threshold Level document (5)

A needs-related syllabus in recurrent training in English for air traffic controllers *(contd.)*

The inventory includes aerodrome and en route events. The following extract shows some of the events for aerodrome control and their related domains.

Events (aerodrome)

A12	SPECIAL FLIGHTS
A13	AIRSHOWS
A14	PILOT'S TEMPORARY DISABILITY
A15	FIRE ON BOARD
A16	BOMB SCARE
A17	PROBLEMS LINKED TO PASSENGER BEHAVIOUR + HIJACKING

Events and domains (aerodrome)

EVENTS	DOMAINS
A13: AIRSHOWS	Traffic information Activity: aerobatics, formation flight Procedures*
A14: PILOT'S TEMPORARY DISABILITY	Health problems Aircraft controls and instruments Pilot actions/behaviour Airfield environment* Airfield installations*

* Domains followed by an asterisk are further divided into subdomains.

Inventory 2: communicative functions

Language functions correspond to the speaker's intention in uttering a given message. For example this intention may be to request information, to complain, to suggest a course of action and so on. The function of a message is expressed in some cases by certain lexical items (eg. "I request ..."), but in most cases it is conveyed through the choice of grammatical structures and prosodic patterns (eg. rising intonation). Identifying common language functions for a given type of communication enables relevant grammatical and prosodic features of the language to be selected and practised. The functions listed in the second inventory of this document were derived by analysing an extensive corpus of authentic and simulated pilot-controller dialogue[4]. These functions have been ordered into four broad categories corresponding to their role in carrying out ATC tasks. These categories are triggering actions, sharing information, managing the pilot-controller relationship and managing the dialogue. In addition, each function is identified as being primarily used by pilots or controllers or both. Below are samples of specific functions identified in each of the broad categories.

1. Communicative functions directed towards triggering actions

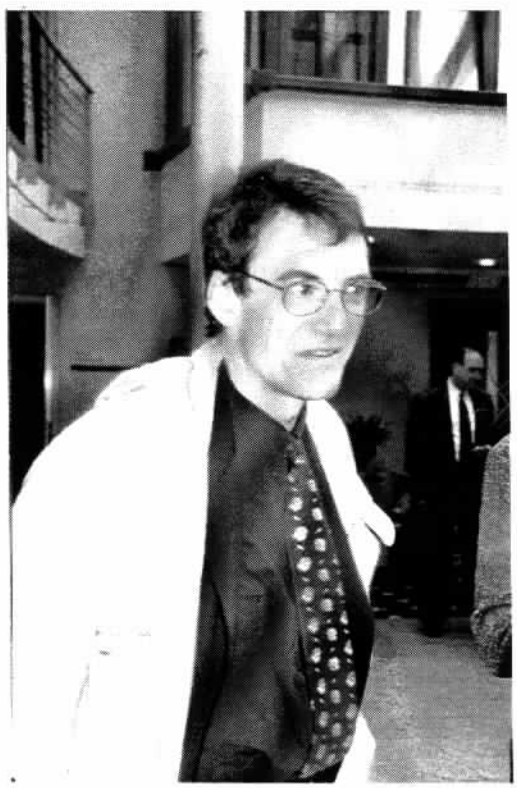
Requests and offers to act

- Making a request (action by other) (C/P)
- Making a request (action by self) (P)
- Making a request politely (P)
- Making a request insistently (P)
- Agreeing to act (C/P)
- Avoiding responding to a request (C)
- Expressing unwillingness to act (C)
- Refusing to act (C)
- Refusing to act politely (C)

2. Communicative functions directed towards sharing information

Information concerning present facts

- Asking for information (C/P)
- Asking for information politely (C/P)
- Requesting a detailed description (C/P)
- Giving information (C/P)
- Explaining aims/precautions (C/P)
- Explaining the reasons for an order (C)
- Describing a state (C/P)
- Describing an unchanged state (C/P)
- Describing an action in progress (C/P)



Jeremy Mell

[4] Part of this analysis is presented in (6)

continued on page 9

A needs-related syllabus in recurrent training in English for air traffic controllers *(contd.)*

3. Communicative functions directed towards management of the pilot-controller relation

- Complaining (P)
- Expressing dissatisfaction (C/P)
- Reassuring (C)
- Thanking (C/P)
- Apologising (C/P)
- Reprimanding (C)

4. Communicative functions directed towards management of the dialogue

- Checking understanding (C/P)
- Checking certainty (C/P)
- Correcting a misunderstanding (C/P)
- Self-correcting (C/P)
- Asking for confirmation (C/P)
- Asking for clarification (C/P)
- Giving confirmation (C/P)
- Giving clarification (C/P)

Inventory 3: interactive modes

The items included in the final inventory of the reference document group together a number of disparate features of R/T communication, all of which however have significant influence on the conditions under which language may be practised in order to prepare for real-life communication. These "interactive modes" therefore influence exercise design rather than exercise content. The modes are divided into four sub-categories: modes of cognition characterise the mental activity of speakers while involved in R/T communication; modes of reception characterise the conditions under which incoming messages must be decoded and interpreted; modes of expression characterise the conditions under which outgoing messages must be formulated and uttered; finally, modes of relation characterise a variable factor in R/T communications which is the relationship at any given moment between a controller and a pilot. The full list of modes is given below.

Modes of cognition
Short-term memorisation
Rapid response to received information
Multi-tasking
Context-induced stress

Modes of reception
Low grade acoustic quality
Regional accents
Lack of visual/kinetic channel
Unexpected input
"Hear-back"

Modes of expression
Dual requirement of concision and non-ambiguity
Clarity of enunciation
Alternate use of phraseology and natural language
Alternate use of mother tongue and English
Placing responsibility through choice of expressions

Modes of relation
Institutional mode
Co-operative mode :
- pooling incomplete information
- collaborative problem-solving

Conflictual mode :
- solution through negotiation
- solution through authority

Conclusion

The reference document that we have described is not yet definitive. It is currently undergoing validation by a users' group. Feedback from this phase will undoubtedly give rise to modifications and improvements. Nonetheless we feel justified in presenting the broad outlines of the document, and particularly the analytical principals on which it is based, in the hope that it may inspire similar projects amongst our colleagues, and in the hope too that it will provide a theoretical underpinning to what they are perhaps already doing in the classroom.

The document provides language content and specifications for the design of training exercises for all except the first of the performance requirements cited in our introduction. Future versions will certainly need to incorporate references to official phraseology where this applies, but for the moment a combined approach to training in phraseology and English language seems to be a distant prospect in many countries. Hopefully the creation within our association of a sub-group devoted to the subject of the quality of R/T communications will bring the advent of such an approach a little bit nearer.

Our argument has been that effective training for English R/T communications can be limited neither to standard phraseology nor by exclusive resort in the classroom to practice materials that simulate R/T communications (as important as these latter materials certainly are). While this approach has been defended principally on the grounds of learner motivation, we would in addition advance the idea that the degree of confidence and flexibility that are necessary to deal effectively with some (thankfully infrequent) emergencies can only be acquired through experience of language use in the widest range of domains possible. ■

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(5) Threshold Level English; J.A. Van Ek, L.G. Alexander; Pergamon Press, Oxford; 1975.

(6) Etude des communications verbales entre pilote et contrôleur en situation standard et non-standard; J. Mell; éditions de l'ENAC, Toulouse; 1992.

DISCUSSION PERIOD FOLLOWING LUXEMBOURG WORKSHOPS

Discussion following Mirna Marincic's presentation : «In what way does recurrent training differ from basic training ? » and Violeta Aldea's presentation: «Whose responsibility is recurrent English training ? »

Discussion chaired by Tony Roome : A variety of questions were posed and answered throughout the discussion and below we have presented those that held the most interest for everyone involved.

Tony Roome introduced the discussion.

The object of the discussion is to find means of motivating students to maintain standards, and to get them to take part wholeheartedly in recurrent training.

Various issues have been raised before such as : promotion bars if people do not reach a certain level, pay increases if they do succeed. On occasions, the most important factor is peer group pressure , that is the groups of people that they work with and who expect them to speak the language they are working with on a daily basis.

How does one conduct the teaching programmes using authentic R/T recordings?

Do you just leave them to listen to the taped radio communication or do you correct it with them in the class or Laboratory ? How do you check that they have actually got the point and can correct their own R/T after hearing the poor example? The only way to convince the students that they do make mistakes is to pass them the example of incorrect phraseology either through a tape or with a transcript as this is the proof that poor radio communications do happen. But the correct version must always be presented at the same time. In fact a constant feed back through daily contact with students, listening to their radio communications and the following day correcting them and following this up with training in the Language Laboratory in order to reinforce the correct phraseology that should have been used is an excellent solution.

Who actually is in charge of maintaining standards in R/T Phraseology, controllers or teachers?

In Sweden it is the controllers. All students already have a high level of proficiency in English, so there aren't that many problems in English.

What motivations exist in pilot training in radio communications?

In basic training there are various ways of learning R/T; either alone with a textbook, with an individual language teacher, or with specific courses geared to the International Radiotelephony qualification. There are, however, throughout the pilot's career certain safeguards to maintain standards as R/T can be regularly checked either by in-company instructors or CAA inspectors. Also with the cockpit resource management programmes the peer group pressure would seem to be stronger in the cockpit environment to maintain correct standards than has yet been achieved in the air traffic control room.

How much are Upper Management Staff involved in this question of motivation for maintaining adequate standards of language practice ?

In certain Eastern European countries, all ATC will in the near future be conducted in English, which of course is a big motivator. However, the ICAO position on the use of English in R/T communications is that two nationals (air traffic controller and pilot) speaking together may use their native language and as language teachers we have to accept this fact. Management should be involved in deciding the amount of instruction, the type of course that may be required, all in consultation with the language teachers.

Is recurrent training based more on procedures than R/T phraseology ?

In fact this is often the case. Nevertheless the role of the language teacher is to emphasise and work on the phraseology, correct pronunciation , give students live recordings and as much variety of listening materials as possible.

Are ATC Controllers working in small airports at a disadvantage compared with their colleagues working in busy international airports?

This would seem to be the case, due to the limited amount and variety of traffic that small airports encounter daily. For these students language laboratories fulfil an important role, particularly with listening, fill in the gap and repetition exercises.

continued on page 11

Discussion Period Following Luxembourg Workshops *(contd.)*

Would pilots need a wider range and variety of English structures and vocabulary to be taught in addition to ATC ?

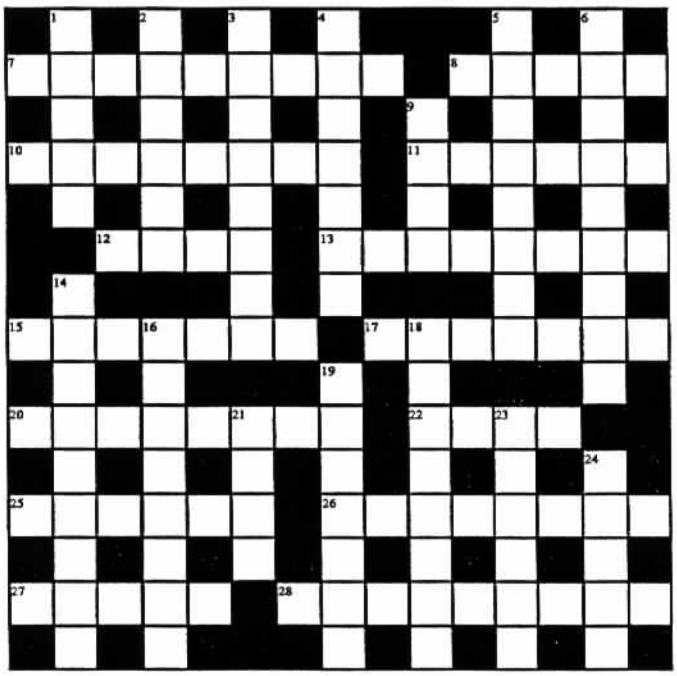
Possibly yes, due to the fact that they need to speak not only to Controllers but also to ground staff, passengers etc. It was pointed out that this is true also for ATC's who work in small airports and need to use a far wider range of vocabulary for ground movements than those dealing with in-flight procedures.

Is there a problem of lack of explicitness from ICAO documents concerning R/T phraseology?

The use of Wilco instead of a complete readback when replying to a controller who asks to report passing flight level 70 is not clearly indicated by ICAO documents, and this is indeed an example amongst many where the language teacher may be unable to give a clear answer to students due to the lack of references and instructions by the authorities. It must be our main preoccupation to teach controllers to listen to the read-back instead of assuming what they think they heard. Should it be possible for associations such as ours to give clear recommendations concerning language use for R/T communications ? This point was to be dealt with later as the implications involved would be fairly considerable.■

25 ACROSS (6 letters) drawn by Jim Walters

AVIATION CROSSWORD



ACROSS

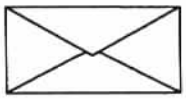
7 Way to the landing? (9)
8 Support for a helicopter ... (5)
10 ... and what must follow climbs (8)
11 Examples of information for airmen (6)
12 Speed unit (4)
13 Connected circuits (8)
15 South London airport (7)
17 Engine with hiccups - location unknown (7)
20 Getting on course for take-off (6,2)
22 Ben Gurion's airline (2-2)
25 Issues information to pilots in underwear? (6)
26 Came home again (8)
27 Aircraft in a heap? (5)
28 ATC authorisation (9)

DOWN

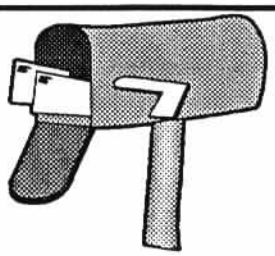
1 Revolver on the tail? (5)
2 Regular signaller (6)
3 Sounds like the Aviation alphabet (8)
4 Moving towards each other (7)
5 Pilot's cockpit devices (8)
6 A sign of safety in the cabin (2,7)
9 Singular part of ATC (4)
14 To set the instruments (9)
16 Visible sign of frost (5,3)
18 Idle type of navigation system? (8)
19 Corkscrews in a dive (7)
21 Sudden change of wind strength (4)
23 Antenna (6)
24 Boundary marker you can sit on? (5)

by Freddy Herring - Anglo-Continental Educational Group

Solution (see page 12)



MAILBOX



Dear Sir,

Regarding the suggestion in Issue 5 that the Association should form an aeronautical corpus for concordancing work:

We have been involved in the design of an ESP curriculum and materials for trainee Gulf Air pilots for the last two years. The students are all Gulf nationals and high school graduates who, after a period of pre-sessional language improvement, graduate to flying school to begin their flying training. This is conducted in English by native English speaker instructors using materials written for native-speaker trainees.

The analysis of materials used by ground instructors for ab-initio training gave us a corpus of around 250,000 words. We wanted a wordlist by frequency in order to target words to be taught in a 23-week Technical English course. We also needed to be able to examine collocations from a large text base for use in the classroom and in addition create a variety of vocabulary exercise types for Computer Based Training. We have used Oxford University Press's MicroConcord, Longman's Mini- Concordancer and OUP'S Adam and Eve extensively throughout this period and found the combination of all three particularly useful. Naturally enough each has its limitations. All three are DOS programs and are not particularly intuitive to use for anybody used to working in Windows.

For our purposes, the major drawback with MicroConcord is that it does not give wordlists by frequency.

The Longman software can produce frequencies but only with relatively short texts of 50,000 words or fewer.

The main problem with Adam (Automated Document Analysis and Manipulation) & Eve (Extensible Variety of Exercises) is that it is out of print. It is particularly useful for rapidly creating, from a corpus, a range of vocabulary gapfill/Cloze and sentence/paragraph ordering types of exercise for use on computer or in the classroom.

A really useful piece of software would combine the following best features of each in a Windows environment

- the frequency information and collocation features of the Mini-Concordancer
- the capacity of Micro-Concord to handle large volumes of text
- the ability of Adam and Eve to quickly create a variety of exercises for PC or paper

Any software writers out there?

The question of synonymy, mentioned by some of your contributors presents the native speaker of Arabic with considerable difficulties. In many cases the difficulty of learning a large amount of vocabulary exceeds the complexity of the subject matter itself. For example, in a chapter entitled 'Wind', a well-known text for pilot training uses the verbs; move, force, rise, ascend, descend, travel, circulate, return, flow, deflect, continue, progress in one short paragraph about atmospheric circulation. The writer uses an array of vocabulary for the purposes of stylistic variety only, creating attractive discourse for the native speaker and headaches for the non-native speaker. Aviation law is also a lexical labyrinth with actions which can be: approved, agreed, authorised, permissible, legal, lawful, legitimate, allowed, cleared etc, etc. The nuances of meaning can be directly translated into some languages but in many cases the meaning can only be conveyed in Arabic by descriptions.

Another problem, so far not mentioned in your newsletter is that of polysemy. Bear in mind the fact that the word bearing as in 'rain-bearing cloud' has absolutely no bearing on the matter of magnetic bearings or wheel bearings. Consider also: provided, mean, element, clear, deal, determined, execute, plane, flush, form, lean, liable, alight, manual, play, property, respect, since, subject, term etc. etc.

There must be a case for some world-wide standardisation of language use in ab-initio training at least. I would be interested in the views of readers.

Sincerely,
David Crocker

The Civil Aviation College
PO Box 4050
Doha
Qatar ■

Solution to Aviation Crossword

ACROSS 7 Threshold 8 Rotor 10 Descents 11 NOTAMS 12 Knot 13 Networks 15 Gatwick 17 Missing 20 Lining up 22 El Al 25 Briefs 26 Returned 27 Stack 28 Clearance

DOWN 1 Wheel 2 Beacon 3 Phonetic 4 Closing 5 Controls 6 No Smoking 9 Unit 14 Calibrate 16 White ice 18 Inertial 19 Spirals 21 Gust 23 Aerial 24 Fence

THE BAD OLD DAYS

Philippe DOMOGALA
IFATCA Representative

What I will attempt to tell you today is how Radio first affected Aeroplanes, and Aviation, why we use Radio-Telephony (R/T in short) today, why we use certain codes, where they all come from, why we use English on the R/T, how things evolved to become standardized... or are they really standardized?

Any form of Communication is imperfect.
You have the speaker who wants to say something, the "receiver" who wants to hear something else and both use "codes" like words, intonation and body language to pass on their messages.
In the first radio communications using Morse you could forget intonation and body language so the "words" were important and needed to be standardized. It has been, still is a hell of a job.

In the beginning, to communicate we used signals. SMOKE signals (you know the Indians, Walt Disney, etc...) then semaphores, then lighthouses, then Radio.

Early Radio Equipment

In Aviation we were lucky because when ORVILLE WRIGHT first flew in 1903 Marconi had already started to use wireless communication since 1896. When one realizes that the first 2-seater aeroplane came only in 1908 and that the first commercial flight (using a 3-seater) was in 1913, one realizes that radio had already proved itself before it was needed for Aviation.

Radio was first developed for TRAINS (U.S. Railroad) and mostly for Maritime vessels.

The first attempt to place Radio Equipment on board an aircraft was in 1910 both in France (in Trappers using a Farman) and in the U.S.A. (Mr. Curdy in a Curtiss) but as no official record was kept, it is difficult to say who was first. The first photograph existing of Radio Equipment on board an aircraft dates from 1912.

It shows a Curtiss bi-plane in New-York (Oct. 1912) The pilot is holding the controls. The radio operator has his right hand on the antenna reel (trailed antenna behind the aeroplane), his left hand holding the Morse key strapped to his knee. The transmitter is behind the seat and the 4 lamps on his feet are used to regulate the power of the wind-driven generator that can be seen above the Pilot. (A very high voltage was necessary to "spark" the transmitter).

You can immediately see the size and complexity of the operations, and the penalty on the performances of the aircraft due to the wind generator, the trailed antenna and the extra weight.

Therefore the first operational radio equipment was put on board Zeppelins of the German Navy in 1913, for communications with the cruiser below, as a warning of what was coming ahead ... a sort of prehistoric AWACS or NIMROD.

In England, the British Sea Scouts Airships also carried radio equipment in 1914. Already by then, a lot of maritime vessels were using Radio Telegraphy (Morse) and there was a real need for some form of standardization.

Early Standardization

In 1910, 10 European countries met and tried to reach an Agreement on Standardization. They failed.

The only thing existing was a code of conduct, defined in Berlin in 1906 which stated:

"There should be a mandatory exchange of messages regardless of the system used"

"Stations are not allowed to disturb each other"

"Priority must be given to emergency signals".

Just before the First World War, Radio Equipment was so heavy and difficult to install that very few aircraft were equipped.

The communication form used then was mostly ground signals, pyrotechnic flares and colored rockets. From that time we have kept the Famous VFR Signals that all pilots should know.

The first standardization rules governing radio were established in London in 1912, when the first International Radiotelegraphic Convention (the forerunner of Int'l Telegraphic Union or I.T.U.) defined a few things.

RADIO TELEGRAPHY : should be done in Morse code using the international coding (several codes were used then) and using a code made of 3 letters starting with the letter "Q" for "question": 45 of these "Q Codes" were established.

RADIO TELEPHONY : (like the Telegraphy in clear words) should be done in the language of the country of destination, and when addressing a mobile station, in the language of the country of registration of the ship or aeroplane.

Regulations were in French, the established official language for telecommunications. (It still is in the postal service today by the way.)

But these first regulations were in fact more destined for ships than aeroplanes. As I said earlier, prior to W.W. 1 very few aircraft carried radio. In fact in 1914, Britain had only 2 aircraft equipped with radio and France 5.

The first equipment suitable for military aeroplanes was

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The Bad Old Days *(contd.)*

only available in Europe in 1918 with headphones sewn on the helmet and a Morse key big enough to be operated with fur gloves, made in U.S.A.

The Germans, during W,W. 1 used a lot of colored rackets both to inform aircraft from the ground, and for aeroplanes to inform the ground. Aircraft carried pistols and a set of colored flares. For the anecdote, German aeroplanes carried flare pistols in their cockpits until 1943. The FOLKE-WULF 190 fighter for instance was thus equipped.

Civil Aviation as such started in 1919.

Early Radiotelephony Equipment

Marconi, the then world leader in radio, marketed its first R/T equipment the Ad-1 that year, and these were fitted on DH 16's (ex-military aircraft converted for civil operations) on the LONDON-PARIS route.

Range was very limited (20 km) and initially only one ground station existed (CRICKLEWOOD, near London) but in 1920 the station moved to CROYDON. Two more stations, one in LYMPNE and the other in PULHAM, opened to provide effective direction finding.

The use of radio telephony was a big problem in a noisy open cockpit environment. Marconi had developed during the war a sound-proof helmet and this was used, but the microphone was hanging around the neck.

International Cooperation

The other big event for Civil Aviation took place during the VERSAILLES Peace Treaty of 1919 where the Allies of W.W. 1 created CINA (Comité International de la Navigation Aérienne).

CINA was responsible for laying down procedures, regulations for operating aircraft, customs services, etc. for Civil Aviation in Europe.

The rest of the world in fact copied the CINA Regulations until 1945, South America and the USA included. The USA tried to form a similar body for the Caribbean, USA and Canada but it was in fact a copy of CINA, merely translating into English the CINA Regulations that were in French.

Initially CINA's work was not very encouraging. This is the first agreed preamble:

"Every aircraft in cloud, fog, mist or other condition of bad visibility shall proceed with caution, having careful regard to the circumstances."

But later CINA did a far better job: it set up 8 ANNEXES (A to H) out of which Annex "D" was the "Rules of the Air" introducing the first form of standardization in radio communications.

Annex D, contained the basis for each radio operator in Aviation:

1. the language to be used in R/T is the language of the state overflown
2. transmission shall start with "Allo" and end by "Terminé"
3. station called name before station calling
4. use of I.T.U. defined Q Codes when no language comparability existed.
5. official documents, regulations shall be in French.

These basic regulations remained in force in Europe until 1947.

When these regulations were published, around 1921, still very few aircraft used radio (still judged too heavy) and for separation the basic rules were applied.

"Look around before taking off"
"follow landmarks like rivers, roads and railway tracks by at least 300 m to the right of them..."
"to cross a landmark do it as fast as possible and at right angles..."
"circle the airfield before landing".

A few signals could be displayed on the ground to inform the pilot of various things (the famous VFR ground signals) and the aircraft could rock its wings in front of people on the ground which meant: *"I want to land ".*

Some more audacious pilots tried to improve the system by adding a barrel roll for "I have tire problems" and a full looping for "I would like to use the other runway" but the Association of Airline Passengers of that time objected strongly to the idea and we were stuck with rocking wings.

3 things modified the system completely:

The first one was the air collision that took place in 1922 between a Daimler Airways DH18 from London to Paris and a Farman Goliath of Grand Express Aeriens on the route Paris to London, near BEAUVAIS all 7 occupants in which were killed.

The second one was that, due to the constant fog in the winter of 1921 above London, a lot of flights had to be cancelled or aircraft landed on alternate aerodromes or sometimes returned where they came from because of that fog.

The third one was the development of the radio tube (valve, lamp) which reduced considerably the size, the weight and the reliability of radio equipment.

These 3 factors, combined with the fact that aircraft were becoming bigger in size, meant that radio equipment was no longer a penalty but a necessity.

R/T and Morse Continue

The 2nd I.T.U. Convention held in Washington in 1927 devised the first series of Q codes reserved for aviation, bringing the number of Q codes to 92.

2 letter-codes for radio telegraphy and R/T were also established (OK for "we are in agreement" is still used today).

In the U.S.A., aviation relied on rotating light beacons (af-

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The Bad Old Days *(contd.)*

ter having briefly tried bonfires, where airlines used to pay farmers to light hay bushes at regular intervals) until 1926, where airlines set up the first RADIO-RANGE BEACONS (left and right signals) and developed their own communication network in R/T.

CINA in Europe introduced a regulation that aircraft of more than 5 seats flying more than 150 km over land or 25 km over sea must be equipped with R/T, and that aircraft of more than 10 seats had to have a telegraphist on board using Morse.

In Europe, radio stations started to flourish everywhere (CROYDON, OOSTENDE, CAP GRIZ-NEZ, ABBEVILLE, PARIS, etc:..) all in the same frequency. All over Europe telephony was on 900 m and telegraphy on 1500 m. The range of these stations being around 100 km and the number of aircraft flying being so low made sure nobody was disturbing anybody else.

Multilingual Pilots and Controllers

Ground controllers gave aircraft only information, never instructions. They gave weather information, QDM's, etc. in ALL LANGUAGES!

Pilots had to be multilingual and when overflying 4 countries, speak the 4 languages. KLM pilots did speak French, English and German in addition to their own language. British pilots all spoke French (difficult to imagine today, I know).

R/T in U.S.A.

The USA were dragging behind. The first control tower equipped with R/T was Cleveland in 1931, replacing lightguns and flags. But still very few aircraft were R/T equipped: in 1930 a US Law was passed to encourage large aircraft to carry 2-way radio by paying a premium to the airlines that would do so.

In the USA, the airlines themselves were running the system, but procedures were not standardized between airlines and no R/T phraseology existed. Pilots were also not too happy about the rule to report their position at "frequent intervals". There were no beacons to do so, so they used landmarks like trees and farms of which nobody else knew the exact position. The equipment was 50 Watt transmitters with no pre-amplication, so the pilots had to shout to make the signal readable.

Only around 1935 did things in the USA change when 4 major U.S. Airlines developed jointly the first 3 Air Traffic Control Centres (NEWMARK, CLEVELAND and CHICAGO) setting up standards and common rules (one that remains still today is "first come, first served") and assigning altitudes and routes to aircraft (the first instructions to aircraft). When all this was fully operational a year later, in 1936, the U.S. Federal Bureau of Commerce took over the facilities and created the Federal Civil Aeronautic Administration the precursor of the FAA.

Popularity of Telegraphy in Europe

In the 1930's in Europe, telegraphy replaced R/T especially for long range communications. With the new "Tube" transmitters, range on telegraphy was over 200 km and the use of Q codes alleviated the language problem. Aircraft were growing bigger, so the transportation of a telegraphist was no longer a problem and it relieved considerably the work of the pilots.

In 1938, the ITU Conference of CAIRO devised R/T procedures and increased the number of Q codes to 140.

Transmission in Q codes in telegraphy was by now extremely fast and prevented confusions. This is an example of telegraphy exchange:

W/T COMMUNICATIONS

1. *PS de G-ABCD QAM PS?*
2. *GCD QAM PS 1000 QBA 10KM QBB 300M 10/10 QAN SW 15K/H QFE 1003 MB*
3. *PS GCD QGA?*
4. *GCD QGP 2 QFM 600M*
5. *GCD QGP 1 QGA*

Translation:

1. *PARIS from G-ABCD request the weather of Le Bourget.*
2. *G-CD from PARIS weather observation 1000h, visibility 10 km, cloud base 300m 10/10th (8/8) wind south-west 15km/h, pressure on ground 1003 Millibars.*
3. *PARIS G-CD request permission to land using SBA? (Standard Beam approach beacon) 1930's ILS.*
4. *G-CD you are number 2, keep circling at 600m (2000ft).*
5. *G-CD you are nr 1, clear to land.*

Wartime Changes in Communications

1939 Then World War 2 broke out and it put a halt to civil aviation (or almost).

The military took over and, because of the war, tremendous progress was made in the Air/Ground Communication field.

As early as 1939 VHF was used by, among others, SPITFIRES of the Royal Air Force (R.A.F.) to communicate directly with the ground radar stations above the English Channel. They used abbreviated R/T from a manual called "Fighter Command Day-brevity Code" (ANGEL for instance was "Altitude" and "ANGEL 15" meant "I ' am at 15.000 feet; MATRASS meant "I am on top of clouds" BANDITS 6 O'CLOCK meant "enemy fighters behind you" etc.).

The US Airforce equipped its aircraft with 2 radio sets, one for long range communications, using longwaves called "Liaison Set" and a short range shortwave set called "Command Set" the latter only used for airplane-to-airplane communications.

The German LUFTWAFFE also used R/T to direct their

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The Bad Old Days *(contd.)*

fighters to their targets using powerful sets. So powerful that the British were able, before a raid, to determine the Air/Ground Frequency in use that day by the Germans, and later when sending their bombers the British were effectively jamming that frequency. The Germans had to find a counter measure and developed later a system allowing the multiplication of frequencies using close separation quartzes. This was the basis of our multi-channel frequency system today.

In 1943, the USA, which had had civil aviation still developing at full speed during the war, started to introduce the first RADIO RANGE BEACONS that were R/T capable, with the ground controller physically located in the beacon. This was the basis of our V.O.R. system and led to the Beacon-to-Beacon Air Traffic Control System as we know it today.

The war also brought drastic changes in aviation procedures, mainly due to the Americans.

R/T Takes Over From Morse

The US Air Force started to use long range R/T with HF across the Atlantic. Americans are pragmatic people and had soon realized the potential of R/T as opposed to telegraphy (Morse). The transmission speeds speak for themselves. They used huge antennas (like the Rhombic antenna of Bronsville (Tennesee), a triangular antenna mounted on 300 feet pylons with a range right through Europe. The US used this to guide aircraft across the Atlantic using Direction Finders.

The phraseology used was typically American: the method of Identification Friend or Foe consisted of asking the pilot (or the controller) to sing a song (popular or a children's verse) to make sure that they were both Americans before transmitting or following QDM'S. The Germans were using counter-measures to divert aircraft over the Atlantic to have them run out of fuel above sea. For large groups of aircraft crossing the Atlantic (and later the Pacific) sometimes over 200 aircraft in one go, special procedures applied where 2 Indians (mainly SIOUX or APACHE'S) were used: One was on the ground and the other on the leading aircraft conversing on R/T in their own language so that nobody (and certainly not the Germans or the Japanese) knew where they were or where they were heading to.

The Americans found the ITU R/T procedures too slow, and developed their own during the war.

History of the Alphabet

The first standardization attempt of spelling letters in R/T dates from 1930 where ITU developed a code using cities.

A = Amsterdam
B = Baltimore
etc...

choosing diplomatically 1 city per important state on each continent.

A-Amsterdam; B-Baltimore; C-Canada; D-Denmark; E-Eddiston; F-Fransisco; G-Gibraltar; H-Hannover; 1-Itaie; J-Jerusalem; K-Kimberley; L-Liverpool; M-Madegascar; N-Neuchatel; O-Ontario; . P-Portugal; O-Quebec; R-Rivoli; S-Santiago; T-Tokyo; U-Uruquay; V-Victoria; W-Washington; X-Xantippe;. Y-Yokohama; Z-Zululand.

But some of the names used were very difficult to pronouce by some nationalities, so ITU in its Madrid Conference in 1932 refined its original list using other words K (KIMBERLEY) became KILOGRAM and Z = (ZULULAND) became ZURICH.

The system was also modified later due to political influences. H was HANNOVER but with NAZI Germany becoming aggressive, pressure was exercised to have Hannover replaced by another city, so H became HAVANA.

This system lasted until 1945. As I told you earlier the US Air Force had already made up their own code during the war, made of shorter words, more suitable for R/T and military operation: A = AFFIRM, B = BAKER, C = CAST, D = DOG, etc... and in 1945 all these abbreviations were used by the Allied Troups in Western Europe.

A-Affirm; B-Baker; C-Cast, D-Dog, E- Easy, F-Fok; G-George; H-Hypo; I- Inter; J-Jig; K-King; L-Love; M-Mike; N-Negat; O-Option; P-Prep; Q-Queen; R-Roger; S-Sail; T-Tare, U-Unit; V- Victor; W-William; X-X-Ray. Y-Yoke, Z-Zed.

So, just before the end of the war in December 1944, the Americans decided to call an International Civil Aviation Conference in Chicago, in a move to impose their procedures on the rest of the world. This succeeded and 6 months later the Provisional ICAO (PICAO) was set up charged to prepare the real ICAO and to define International Civil Aviation Procedures. If they copied the CINA administrative scheme, the basic difference was that the working procedures were U .S. Little resistance from other European states occurred, and this is not surprising if one remembers that the U.S.A. were the master winner of the war and were the only Allied Force which had kept full civil aviation operation during the war, and also that 90% of the civil aircraft flying in 1945 were U.S. built.

Again history is repeating itself. Following World War 1, CINA was set up by the winning party and France imposed its views, following World War 2 the Americans did the same.

In March 1947, PICAO became ICAO and the U.S. procedures were slightly modified to meet the need of the rest of the world. To come back to our alphabet spelling example, the lst ICAO alphabet set up in 1947 largely took over the U.S. one with some slight modifications to prevent misunderstandings.

A-Abel; B-Baker; C-Charley; D-Dog; E-Easy; F-Fox; G-George; H-How; I-Item; J-Jig, K-King; L-Love; M-Mike; N-Nan; O-Oboe; P-Peter; Q-Queen; R-Roger (!); S-Sugar; T-Tar; U-Uncle; V-Victor; W-William; X-X-Ray; Y-Yoke; Z-Zebra.

A (AFFIRM), N = (NEGAT) were replaced by ABEL and NAN. R (ROGER) was planned to be replaced as well but

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The Bad Old Days *(contd.)*

the U.S.A. opposed for God knows what reason. (People representing their state in ICAO had not always the adequate Aviation R/T background needed to make the decisions at that time).

But some words were still very difficult to pronounce for some nationalities like O = OBOE and T = TARE, etc... and again, like ITU had to do in 1932, ICAO had to revise its copy and come up in 1954 with the alphabet as we know it today, using English words made of Latin roots.

A-Alfa; B-Bravo, C-Charley; D-Delta; E-Echo; F-Foxtrot; G-Golf; H-Hotel; I-India; J-Juliett; K-Kilo; L-Lima; M- Mike; N-November; O-Oscar; P-Papa; O-Quebec; R-Romeo; S-Sierra; T-Tango; U-Uniform; V-Victor; W-Whiskey; X-X-Ray; Y=Yankee; Z-Zulu.

For the sake of the anecdote, one can remark that Q for QUEBEC and Z for ZULU were back from the first original alphabet in 1930.

English for R/T in Europe

In 1948 civil aviation in Europe was reorganizing, the Americans occupying Western Germany and being present in most of Western Europe used R/T in English between their aircraft and the ground stations, and tried to force European airlines to do the same.

But W/T was still superior, especially over long distances, codes were used, precise, fast and the first coding machines were becoming available, so W/T had the preference of the Europeans, who had also some 15 languages to cope with.

If the Chicago Convention of 1944 did not mention R/T except to refer to ITU Cairo Convention it was clear that English R/T was in the mind of the Americans when ICAO designed its Annex 10 (Communications).

Although it retained the original 1st Recommendation of ITU it immediately added that "Pending the development of a New Language for aviation, English should be used... or made available". That was it. A working group of ICAO called IL (International Language for Aviation) was set up but it soon became clear that unless we created something like ESPERANTO (that nobody wanted) it was a doomed task so finally they agreed to make ILA "based on the English language" and "created" (in fact took over) words like CLEAR, ROGER, WILCO, etc.

The big blow to W/T came on the North Atlantic route, where the major American Airlines created jointly NARTEL (North Atlantic Radio Telephony Committee) with R/T VHF stations all around the Atlantic. ICAO under the pressure of the Europeans increased their Q codes to 248, covering each and every possible message, but the battle was lost. The surplus of war aeroplanes (DC3, DC4, DC6's) were all American and acceptance of US procedures was only a matter of time.

The End of Radiotelegraphy

A few events in 1953 buried the European chances for telegraphy all together.

First the European Airlines started to join NARTEL, then the second bath of VHF frequencies (from the 30 channels plan) was implemented in Europe, and some new aircraft (the Convair 340) were only equipped with R/T (HF + VHF). The main disadvantage to R/T over long distances was for the pilots to maintain a constant listening watch on a busy frequency full of static. This last disadvantage disappeared in December 1953 with the arrival of SELCAL equipment (Selective Calling), the same equipment as we know today.

In 1954 the first commercial jet aircraft, the COMET, in a different move was equipped with a radio operator position with telegraph. But by 1956 everybody knew that telegraphy was condemned. The D-7 arrived with no place for a radio operator in its cockpit and the airlines were in fact supporting this move to have the pilots taking over the communications in an increase-profit-idea (one staff member less to pay and one passenger more on board). However, the standardizations of procedures on a worldwide basis were far from established.

Airlines, especially U.S. ones, were still operating their own radio stations (in R/T) around the world for their own aircraft. Zones of influence, like South America, West Africa and Indochina still used telegraphy and when R/T was used it was in Spanish or in French.

Language Problems with R/T

An interesting anecdote on what happened in BANGKOK in 1955-56 when AEROSIAM, the employer of the official telegraphy station, decided to switch to R/T. Firstly the radio operators and controllers did not speak English and had to be trained... they asked for more money which ended up in disputes... delaying the program. By 1957 only a few Thai operators used English on R/T but with such an accent that the Scandinavian and Dutch pilots (the principal users of the local airspace then) were unable to understand them. The other big operator PAN-AM had its own radio network with its own US operators and did not use Aerosiam while Air France and all the neighbouring airlines (Air Vietnam, Cambodgia and Air Lao) only used French ... So you can see the problems.

But the next big events which helped the Americans was the failure of the COMET as a world airliner and the arrival in 1959 of the BOEING 707. The 707 was only equipped for R/T, done by pilots and the crew of all airlines operating that jet aircraft were trained in the USA on US procedures. The DC8 arrived one year later equipped with transistor radio equipment (10% of the weight of conventional equipment + no maintenance). The last Aviation Telegraphy ended in 1962 when the last South American station closed down, replaced by HF.

R/T won and English was the language used. Standardization tried to make everybody understand each other but it was and it still is difficult.

History shows how politics have influenced the system from the beginning.

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The Bad Old Days *(contd.)*

An anecdote from 1906, 80 years ago ... In the first Maritime Radio Conference in Berlin that year, an international distress call in Morse had to be chosen. Everybody used then CQD (CQ for "attention all stations", and "D" for "Danger") only the Germans used S.O.E. (Telefunken code). Since the conference was in Berlin, to please the Germans - S.O.E. - was chosen. But as the letter E was not so distinguishable in Morse, it was later decided, for symmetric reasons to use SOS (3 dashes - 3 dots - 3 dashes).

Bad habits also disrupted the system

We still use today Good Morning and Good-bye in almost every transmission despite the desperate insistence of ICAO to eliminate this "Polite Jargon" as they call it. But we did not invent it. In 1900 operators of Marine Telegraphy invented their own code, starting their messages with GA or GM (for Good Morning and Good Afternoon) instead of the mandatory letters and ended their transmission by TK.OM (for thank you old man), OM became the signature of "veteran certified operator".

Regional Influences

Procedures still vary from state to state. Most countries use their own language for R/T in addition to English with emphasis on their own language. Large countries like USSR use Metric System (an ICAO Recommendation by the way) and different Navigation Equipment, etc... But even between English speaking natives using the same system problems do occur.

I have a nice anecdote, a conversation between a British pilot and an American controller, taken in DAYTON, Ohio some 3 years ago.
You know British pilots use QFE on landing.
In bad R/T this becomes "FE".

Our British aircraft was approaching DAYTON, where one of the local operators Federal Express's Mystere 20's had for registration N + 3 numbers + FE as callsign. So the R/T went like this:

British a/c :	"DAYTON do you have the FE?"
APP :	"FE? He is on Tower .119,7 ..."
British a/c :	"1197, thanks ... Eh ... is that not a bit too high?"
APP. :	"What do you mean?"
British a/c :	"I mean the FE, is a bit high no? You must have made a mistake."
APP :	"Stand-by ... Negative the FE landed 5 minutes ago"

... and this went on for a few more minutes.

Even in radio telegraphy today we have 3 Morse codes.

In 1987, today in Europe, ICAO is not able to force countries to standardize their VOR callsigns. . BGS is BURGOS in Spain, and BURGOS in Bulgaria, RBT is RAMBOUILLET, RABAT and RIBNO ... wonderful when you have to program an FMS. And nobody wants to change HIS particular VOR.

CONCLUSION

Well ... we have now travelled through 80 years of radio communications. As you saw, nothing came easy and there were reasons behind everything that we do and say when using R/T today.

What can we recall from this presentation:

We have learned today :

- that radio was made for the railroad and the navy, for aeroplanes.
- fortunately the Germans lost WW1 otherwise all the Rules of the Air would have been in German.
- if the first ICAO Conference had been held in Paris instead of Chicago we would all be speaking French today... maybe even on the R/T above U.S.A.

On a more serious note, automated machines could have taken over a great part of routine telecommunications using Telegraphed Morse Q coded info... Data link between ground and aircraft that could have passed route clearances, weather info's, etc... and position reports, speed, requested FL'S, the other way (from aircraft, to ground).

All this could have been done automatically with technology available in 1956. ICAO FANS (Future Air Navigation Systems) is now thinking about bringing such a system back, using satellites and Mode S transponders. A similar thing but hundreds of times more expensive and most of all... built by American companies.

ACKNOWLEDGEMENTS

When researching this present talk I discovered that very little material existed on Aviation Radio Telephony especially in Europe. I am therefore very grateful to the few individuals who, by their anecdotes and memory helped me to put this together.

They are:

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René FRAJ, ex Gonio (D.F.) Controller in 1950's in Indochina, Africa, France, Aspet, France.
Glen NASH, ex Boeing ,Air Transport Company Controller in 1920's, later Lighthouses Service, Scottsdale, Az, USA .
J . FONTAINE, I.T.U. Archives, Geneva.

and the fantastic book (unfortunately only in Dutch) by Klaas Houtkoper, ex-wireless operator by KLM about radio adventures with KLM DC2's, DC6's and super constellations in the 40's and 50's.
"Het Onsterfelijk Alfabet" Heerlen 1981, ISBN 90.64.0085.

(This talk was given at the Third Aviation English Forum on "Language Standardisation in Aviation", March 1987. It was first published in the report of the proceedings.) ■

THE INTERNATIONAL AVIATION ENGLISH ASSOCIATION: A BRIEF DESCRIPTION

HOW WAS IT BORN?

The initial impetus to form the Association stems from the very positive international response to the Aviation English Forum held periodically in Paris over the past eight years. It became apparent that a great many people working in this field worldwide needed a structure within which they could establish and pursue contacts and keep abreast of events in the fast-evolving worlds of Aviation and English.

WHAT ARE ITS AIMS?

1. To **bring together** people and organizations concerned by or interested in the use of English in the aviation and aeronautical world.
2. To **promote** the exchange of information as regards English, English training, standards, qualifications, translation, documents, etc., between people working within Aviation in different countries.
3. To **gather** information useful to the airlines, Authorities, Air Traffic Services, manufacturers, pilots, engineers, universities, research institutes, training centers and teachers.
4. To **enhance** the circulation of this information through a Newsletter and one-day seminars and periodic forums.
5. Finally, to **generate** concern about the quality of English in the aviation world.

WHO ARE THE MEMBERS?

Airline training managers	Translators	English Language Teachers
Pilots	Representatives of Civil Aviation Authorities	Technical editors
Engineers	Researchers	Air Traffic Controllers
Professional bodies (IFATCA, IFALPA, IATA)	Military training departments	Manufacturers' Documentation Departments

WHAT ARE SOME OF THE ISSUES ADDRESSED?

- Language requirements for aviation professions
- Ambiguity and interpretation in phraseology
- Standardization and clarification
- The role of English with respect to other languages, etc.
- Autonomy in language learning
- The promotion of Simplified English
- Language standards and testing
- The human factor in communication and learning
- Efforts required by native speakers to use English as a language of international communication

For the conditions of membership, please see the APPLICATION FORM enclosed.

HUMAN FACTORS IN ATC?

SOME SAFETY-RELATED CONSIDERATIONS

A. Barba

Shocking as it may seem, air traffic control is the sort of activity where trainees at academies receive a constant reminder of the grave consequences failure to apply or conform to commonly approved procedures (mostly at internationally agreed level) might entail, yet the ATC profession as a whole, once graduated from academies seldom refer to or receive any training on error recognition and awareness, or indeed on any other main safety issues directly related to the everyday performance of their jobs. Human factors training in ATC has been ignored until very recently, and it is only latterly that investigators looking at the possible involvement of air traffic controllers after an air accident ask themselves how to increase safety levels in ATC actions, and whether preventive HF education might have avoided an avoidable accident.

The preceding statement does not apply though in the case of air crews, either flight deck or passenger cabin, subject also to diverse psychological, physical and environmental pressure and constraints whenever an in-flight problem arises. The following article aims at introducing the basic aspects of human factors (HF) in ATC, with special focus on message exchange and language issues (message production). Some pages are also dedicated to a consideration of the philosophy behind ATC-referenced accident prevention through the growing understanding of some key elements contributing to the causal chain leading to an air accident.

THE CONTRIBUTING FACTOR

By looking at commercial airline accident figures for 1995 (Fig, I) we can easily assess how most of fatal/non fatal accidents had as a main causing factor either some improper action by the pilot (58%), including unawareness or failure to respond to a dangerous flight attitude by the airplane in time. Weather and other systems failure account for a lesser percentage, whereas ATC action as a major cause for an accident rates at a (surprisingly) low 1.7 %. We should not be misled somehow into thinking that airline managements want their crews to have training on possible accident causes because they are more prone to error than other aviation professionals like controllers, maintenance engineers, etc. Neither should ATC managers sit back and relax thinking that because air traffic control gives such apparently high safety rates (or low accident percentage) the need for error awareness training is less. As recent Boeing and other studies have shown, even at the current rate of safety improvement, traffic increases will push up world-wide fatal air accidents to an average 35-40 by the year 2010, and it is for the ATC community to ensure that its 1.7% share in air accidents is further reduced.

FATAL ACCIDENT CAUSES
1995
source: Flight International

MAJOR CAUSE	No.OF ACCIDENTS	PERCENTAGE
Aircrew error	37	65%
Controlled flight into terrain	21	37%
Weather	17	30%
Loss of control	8	14%
Engine failure/fire	9	16%
Structural/systems failure	6	11%
Operations error	6	11%
Maintenance	1	1.7%
Airframe/systems fire	1	1.7%
ATC error	1	1.7%

Fig. I

We should therefore make ourselves a few considerations. Firstly, we must be ready to admit that out of the comparatively low participation of ATC in the overall major causes of air accidents, our involvement lies somewhat covert as a contributing factor rather than as a major factor in probably more cases than we think, specially if we notice from the published figures that recurrent major causes like "aircrew error", "weather", "systems" or "ATC error" seem to stand out in isolation, without taking into account the complete train of events amounting to the flight's "story" and the interaction of the different variables during a flight until it suddenly came to a sad stop.

Secondly, we should be able to identify and evaluate a second category of variables which affect the performance of the air traffic controller at work, namely motivation, awareness, mental and physical fitness, man-machine interface conditions (MMI), as well as the appropriacy of procedures and speech production to ensure correct responses and actions from pilots. HF helps by making an early analysis of each of these variables and the possible errors arising from interference between any one, two or more of them, and finally produces guidelines to avoid the occurrence of the same situation which might lead to yet another air disaster.

To illustrate the need for a deeper understanding of the conditions affecting an air traffic controller at his job, and the interaction his decisions might have in the safety of a flight it is worth mentioning the fatal crash last December of the American Airlines Boeing 757 near Cali, Colombia, where an experienced crew failed to carry out the appro-

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HUMAN FACTORS IN ATC? *(contd.)*

priate pre-descent briefings and checks after having accepted an unfamiliar approach procedure offered by ATC. The result was the loss of 163 lives and a verdict of blame on the pilots because of flagrant breach of standard operating procedures, but not without previous questioning of the conveniency of ATC offering alternate procedures to aircraft.

WHAT ARE HUMAN FACTORS?

As pointed out earlier, human factors have to do with people, their working and living environment and the relationship of people with the equipment they operate, the procedures they apply and the interaction with other people. Following Hawkins we can say that the most appropriate definition of HF is that "it is concerned to optimise the relationship between people and their activities by the systematic application of the human sciences, integrated within the framework of systems engineering".

Ever since 1869 psychology as a science has taken an interest in the study of time reaction for task performance (TR), followed by works during the 1880s and 1890s on time and motion studies in industry which boosted the importance of man-task-equipment interface in the consecution of a quality product. The importance of HF was subsequently settled when the so called "Hawthorne Effect" demonstrated scientifically that work effectiveness could be favourably influenced by psychological factors not directly related to the work itself (1930).

Nevertheless, the field of HF entered aviation with prewar experiments being run at a cockpit simulator at Cambridge University, UK., which helped establish that three out of four aircraft accidents are due to some kind of human error, whereby ergonomics, or HF -ergon (work) and nomos (natural law) was established as a technology in its own right. Furthermore, accidents like the TWA's Super Constellation and United Airlines DC-7 mid-air collision in 1956 over the Grand Canyon or the Tenerife Disaster in 1977 prompted the respective creation of agencies like the FAA in charge of the safe and efficient utilisation and manning of their airspace, or the creation of HF Awareness courses by carriers in order to make their crews more error-conscious, following the advice of the IATA's 1975 Technical Conference held in Istanbul which highlighted, only too late, the importance of HF in commercial aviation.

It was this latter crash however, together with the previous year's BEA-Inex Adria crash over Zagreb Yugoslavia which provide the real starting point for research on HF affecting ATC, with special focus on communication and language problems between controllers and aircrews derived from the different languages present during communications, the lack of sufficient communicative competence in English and an improper use of ATC phraseology.

Although apparently the field of message exchange between pilots and controllers appears as more controversial, as each is subject to different interpretation, interference from other stations or frequency overload, the creation of confidential incident notification reports like FAA/NASA's ASRS (Aviation Safety Reporting System) in 1976 or the U.K.'s Confidential Human Factors Incident Reporting Programmes (CHIRP) in 1982 have contributed to clarify the picture of what other elements might be playing a role in the everyday operation of traffic from the ATC point of view.

ATC ERROR

Basically , an ATC error indicates some mistake due to misjudgement or misunderstanding of the air traffic controller in his or her interaction with a) an aircrew member, b) the system he/she operates, c) a fellow controller, d) the ATC environment. What HF is concerned with is the elements and circumstances behind an error or misjudgement, so potentially serious as to impair safety when one or more are linked together to form "the chain of events leading to an accident". An attempt to develop a simple model which focused on the main elements intervening in any human-related task was made in 1972 by Edwards (the SHEL model), and it helped to clarify the path we should follow when trying to analyse the interactions between controllers, pilots and the surrounding environment. An experienced controller will be able to recognise as familiar the errors that take place when a good Shel model is not carried out in his unit.

Liveware, as the first and most important component deals with man himself, the centre of the system, It has to do with his physical and mental fitness, food and rest habits, sensitiveness, alertness and capacity affecting his responses. The speed with which he/she manages new information is determinant to establish his/her adaptability to the environment. Rest-rooms, training scheduling , gyms or catering services at work are examples of how problems arising from these factors can be minimised.

Liveware-Hardware interface, or man machine interface (MMI) has to do with good working conditions, well-designed workstations and comfort helping concentration. A good example of controller-minded L-H is the independent ventilation and cooling systems for staff and workstations at the new control room in Maastricht ACC.

Liveware-Software offers less evident problems, and has to do with symbology, procedures and layout of information on the screens or checklists involving some kind of mental processing. Conflict alert systems constitute an example.

Liveware-Environment has a lot to do with ergonomics if we consider that at first it was the controller adapting himself to the tower or control room conditions rather than the environment matching the controller's requirements. Just think of air conditioning, or shaded glazing at towers or a pair of simple binoculars making life easier for all, and work safer!

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HUMAN FACTORS IN ATC? *(contd.)*

Liveware-Liveware, mainly concerned with aspects of teamwork and personalities, relationship and cooperation among the different members of a team. Also with controller-pilot attitude during communications interchange.

The SHEL model described above is aimed at identifying sources of error through the description of the various interfaces present in any task performed by man. Although the ATC system , as well as aircraft operations , present carefully developed procedures and an increasing strength in terms of safety and error-free equipment manipulation, why should there be ATC-related accidents at all? The fact is, systems that depend almost entirely on human judgement and vigilance are obviously subject to error, and the potential for a near-miss or an accident is always there. Concerted efforts to reduce its human shortcomings and to optimise its human strengths by further research on the causes of error and the early identification of potential errors themselves must be made by taking a prevention-mode approach.

SOURCES OF ERROR

A deeper look into the interaction of elements in the SHEL model permits us to group several of these elements under better recognised categories.

A) SYSTEM WEAKNESS

A controller's job consists mainly of separating aircraft, monitoring traffic flow and acting in response to traffic or aircrew's requirements. A new category of task with no evident -at times- direct impact on safety issues may be added nowadays under the title of flow management action. Tasks are performed within the framework of diverse ATC systems and sub-systems which provide the environmental, edited or otherwise technical support required for the safe and smooth running of the overall ATC system. An important function of effective air traffic management is the identification and correction of system errors which occur as a result of basic weaknesses inherent in the composite man-machine system.

More specifically, an ATC system error could be defined as an operational error in which a failure of equipment, human, procedural and/or other system elements, individually or in combination might potentially result in an impairment of safety. It is in fact a penetration of the "buffer" zone around a controlled aircraft, where the dimensions of the zone are minimum standards for horizontal and vertical separation distances. Each system error can be assigned a number of major or contributing causes, all responsible for ATC task failure in an operational environment:

a) poor operational procedures, including manuals, letters of agreement, sectorization, etc.
b) poor or insufficient training sessions; lack of refresher courses.
c) inadequate functional ergonomy of workstations.
d) problems due to poor management (e.g. inadequate rest scheduling).
e) inappropriate working habits.

B) PSYCHOLOGICAL FACTORS

a) problems based on delayed sensing and perception abilities (information processing).
b) expectation/reversion: e.g. insufficient adaptation to new radar display functions.
c) motivation/boredom.
d) low arousal/alertness levels.
e) incorrect weighing of factors resulting in incorrect decision making.
f) false hypothesis or mistaken assumptions (extremely resistant to correction).
g) memory or retention problems.
h) high expectancy in verbal communication.
i) the authority ingredient: not questioning an incorrect decision by a senior colleague.
j) stress.
k) over-reliance/insecurity.
l) fatigue.
m) frivolousness, leading to excessive communications familiarity and relaxation of procedures.

C) COMMUNICATION/LANGUAGE PROBLEMS

Of the three categories we can identify as the main sources of human error at ATC language use expressed in the construction of exchanged messages constitutes a basic, if not the first concern of the air traffic controller. Framed, neatly structured communications (verbal/non verbal) are continually passed on between aircrews and controllers, between one or several controllers and, ever more frequently, between controllers and their increasingly automated equipment as well as between automated systems or subsystems (e.g. on-line data links after automated flight activation). Yet ATC communications have seldom been studied in their own right in HF terms, with scientific measurements of the effects of known and specified variables in communications on controller performance or system efficiency. In effect, they constitute a relatively neglected HF topic.

Voice communications is the primary means of information transfer in the ATC world. The outstanding characteristics of speech in ATC are its flexibility, complexity, immediacy and freedom from restriction, giving rise to a whole series of rules, conventions, formats, codes and terminology which have to be imposed and standardised in order to ensure that ATC messages are universally intelligible, accepted, and produce the desired effects in an error-proof way. Again, the errors arising from the incorrect

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HUMAN FACTORS IN ATC? *(contd.)*

or improper use of ATC speak mix with environmental and systems factors, albeit with a distinct character of their own.

a) Error due to deficiencies in the surrounding environment or ergonomy lacks, which work against desirable perceptiveness and awareness,

- inadequate automated communication functions.
- noise-contaminated environment.
- conditions causing discomfort and which favour stress.

Errors due to inefficient or flawed ATC procedures,

- need for excessive co-ordination.
- complicated or unclear procedures requiring time-consuming clarifications.
- use of local language (regardless of ICAO sanction) when foreign aircraft share the frequency, which has contributed heavily to accidents like the one already mentioned 976 mid-air collision of a British and a Yugoslavian commercial aircraft over Zagreb.

c) Errors due to incomplete ATC/aircraft message production,

- word dipping/dropping.
- expectancy or "wishful hearing".

d) Errors due to insufficient communicative competence

- lack of grammatical competence: syntax (word function) errors, incorrect pronunciation, misleading intonation -in Spanish language, for example, word order is much freer than in English; compare: "The aircraft more close has reported five miles" which will come out to a Spanish national in a natural way, following word structure in his/her mother tongue, with "The closest aircraft has reported five miles".
- lack of textual competence: poor cohesion and organisation of messages, e.g. "The five miles aircraft has reported".
- lack of pragmatic competence (what we say, and what we really wanted to say), expressed through direct or/and indirect speech acts: "The five mile aircraft is closest".
- lack of sociolinguistic competence, described as the sensitivity to, or control of the conventions of language determined by the features of the specific language use context: "the nearest airplane is nearest is five miles away".

THE FUTURE

The present ATC system operates in a manner which greatly relies on the mutual cooperation existing between aircrews and controllers. Advanced electronic displays and workstations at control centres and towers have been developed with safety and airspace efficiency as a major goal.

Because aircraft flight deck systems have received similar attention, albeit with safety and this time economics acting as major factors, we can think of 21st century air transport management as an activity in which aircrews and controllers will share highly automated and technologically advanced instruments.

As the trend toward further automation continues with the incorporation of satellite navigation features like ADS and GNSS, or full implementation of reduced separation based on the data link potential offered by Mode S transponders and common radar-processed interrogations, co-operation must be preserved through the provision of information through these systems in a manner that permits the users a shared, real time and fully reliable awareness of what is going on within the airspace they fly or control.

We used to think of human error mostly occurring in the cockpit, and HF has historically focused its attention on the flight deck because that is where decisions are taken. Shared information and close co-operation have turned their attention to the ATC environment and HF issues affecting the controllers . Innovative and flashy systems like TCAS, data-link communications or conflict alert advisories at the control room present the somewhat professionally conservative ATC community with serious doubts whether the remedy is not worse than the illness.

Timely and adequate assessment of HF issues in air traffic control could only mean better understanding and respect for our profession and increased job satisfaction, amounting definitely to increased air safety. When speaking of air accidents, or how to prevent them, it has become obvious that safety is best served by a multiple-layer look at the event and its underlying causes, plus a new approach to prevention by systematically examining through education and training the issues that might contribute to cause an aviation disaster, and that entails a sound, sensible approach and cognition of the psychological, environmental and communicative elements of our job as air traffic controllers in our quest to avoid errors. After all, as the engineers saying goes, an air traffic controller is a non-linear servomechanism that can be easily mass-produced by unskilled labour. Or are we not? ■

SKYTALK

Harland Goertz

"Cwical enyin shu down", the man said.

"Sorry, I didn't understand", responded the computer. "Critical engine shut down" it repeated aloud.

The man clicks an icon on the screen and views the model voice wave pattern of the phrase next to a view of his last repetition to see the differences. He listens again to the model speaker's voice and practices his response several times, each time receiving a score from the computer. Then he replies, "Critical engine shut down".

"Good", says the computer and moves on to the next phrase.

This was the scene in the Conference Room at Eurocontrol Training Center in Luxembourg as Harland Goertz of Skytalk, USA gave a live demonstration of new computer-based aviation language training software at the May Conference. The product, called SKYTALK, uses an interactive approach between student and computer using the latest speech recognition technology. Trainees in radiotelephony can use this new product to greatly improve their pronunciation of words and terms common to ICAO phraseology. Two versions of SKYTALK will be available in the Fall of 1996 - one for controllers and one for pilots. In both, the computer engages the student in RT conversation, listens to the student, evaluates his pronunciation and gives him a score. The student can choose from several different exercises to practice his speech. The SKYTALK product operates on a personal computer with sound and CD-Rom capability.

Mr. Goertz told the conferees that SKYTALK was designed by a team, composed of an air traffic controller, a user requirements specialist and a computer engineer. It combines traditional air communication phraseology used by pilots and controllers with the latest in interactive speak and respond speech technology. The software capitalizes on the advances in speech recognition developed for language training in the European market over the last five years. SKYTALK employs audio, both heard and spoken, as well as visual training tools. It has been designed to offer a variety of training methods to appeal to students at all levels. Skytalk offers varying learning approaches, such as visual cues, aural repetition, listening to sound recordings and playing games. The SKYTALK software contains:

- adjustable levels of difficulty
- option to suppress display of correct answer, to improve recall
- color display of score on screen for immediate feed back
- unlimited replay of sound and response loop until student is comfortable with any phrase
- instant replay possible of any model speaker or student response
- word association games
- display of voice wave pattern of model and student available on any phrase
- option to start lessons at any point in series
- facility to review all phrases, one at a time, in alphabetical sequence.

Its strength is the diversity of techniques available to the student, ensuring that everyone can find exercises that suit his/or her skill level and preferred learning method. It is a stand alone system with no instructor necessary. It can provide endless repetitions of lessons and speak-score-repeat sessions without loss of patience or consistency. SKYTALK© could be used in any facility for pilots or controllers to practice, improve and maintain their proficiency. Both the pilot and controller versions are based on probable conversations between pilot and controller, as well as practice with the international alphabet, emergency words and terms and airplane parts. Over two hundred and fifty words and terms have been included from the ICAO standards.

SKYTALK is not planned as a substitute for language teachers or classroom instruction, emphasized Mr. Goertz. It was designed to help students with pronunciation and vocabulary as a part of a complete RT program of study. ■

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For the attention of the Editor

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