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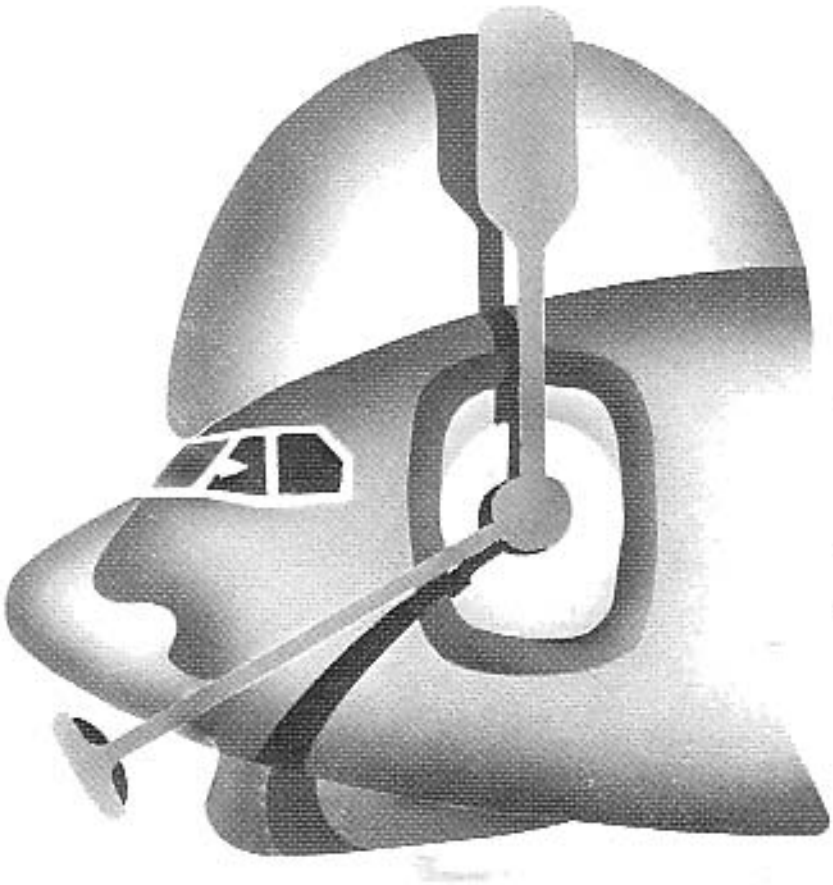

THE VITAL LINK

REPORT

INPUT

the magazine of the
EUROCONTROL GUILD of AIR TRAFFIC SERVICES

Contents

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OutputOutputOutput

Generally the opinion exists that R/T remains the weak link in ATC systems. This interface has often led to deplorable incidents and, sadly enough, to tragic accidents. Similar occurrences should be avoided in the future. Can we to that effect optimize R/T procedures and techniques or will other systems, such as a data link, ultimately substitute voice communications? Many related subjects have been discussed during the Forum "R/T - The Vital Link", organized by EGATS and held at the Motel in Heerlen on April 24 and 25. The Forum provided a platform for discussion between pilots, controllers and industry with the objective:

* to become better informed about mutual problems; and
* to achieve safer and more efficient operations.

This double issue of INPUT includes for the larger part a report of this two-days event, that is it comprises the full presentations given and some interesting parts of the discussion, although some restriction had to be imposed here.

Once more EGATS wishes to express its sincere appreciation to those who have supported this initiative, namely AKG, AMRO Bank, Cardion Electronics, Clement Clarke International, Eurocontrol, Fokker, Hamilton Standard Stork, KLM, LTU, Maastricht Airport, NLM City Hopper, Philips, Schreiner Airways and Thomson CSF. In addition, EGATS would like to thank the Limburgs Dagblad for their valuable cooperation in the production of this report.

Before we go into the meat of the Forum one other point is to be mentioned. For several reasons I will cease my activities as an editor. To all those who have assisted me in the past: many thanks! Continuity, however, has been ensured: Patrice Behier will take over, assisted by Norman Brown, Joe Florax, Geoff Gillett and Paul Hooper. The artist impressions will still be provided by Martin Germans.
Many success!

Rob.

Our success....we do start early with Eurocontrol!

don't forget
(WRITE IT DOWN)

Next Copy Deadline:

August 24th.

Entente Cordiale -

by Philippe Domogala

A French Air Force base near Paris in the sixties... That winter morning I was assigned a triangle navigation training flight with "Moustache" on a Dassault 312. Moustache was a 48 years old half-bald instructor who contrary to his name did not wear any upper-lip hair. This surname came from the Algerian War, where he was one of the most decorated T-6 pilots and, in French Air Force slang, a very good pilot is known as a "Moustachu", whatever the hair style.

As it was nearly freezing outside, Moustache sent me to do the pre-checks while he went for a cup of coffee. While I was still inspecting pins and kicking tyres, Moustache came back accompanied by a much older gentleman, dressed in a brand-new flying suite.

"Eh, you, come here!" ... said Moustache, "this is general XXXX, he has to go to England and will use our plane. You come along and you will do your navigation exercise on the return leg ...".

"Yes sir!!" ... What a change compared to our local flights! My enthousiasm was, however, diminished when I found out that the general was acting pilot-in-command, Moustache co-pilot, while I was to ride on the jump seat. This particular general was a pilot and he was using this liaison flight to keep valid both his licence and the extra money that goes with it. Everything went perfect until we reached the Channel.

Moustache was well known in our squadron for his poor mastering of the English language. He came from Beziers in the south of France and this town is known to produce the best rugby team; its accent is close to incompatible with the Anglo-Saxon terminology. Fortunately for him most instructor duties were done in French. As it turned out the general, although coming from another town, shared similar difficulties and both of them thought the other one was fluent enough to do the R/T.

When France switched us to London, there was a long pause after the proper frequency was set ... Then the general used his authority and said: "Well, Moustache, will you call them?"

A look of incredulity passed briefly on Moustache's eyes, but after a short pause he finally grabbed the microphone "Eh, Londone, zeeze eeze Foxe Maike zero five zeven zero...".

Suddenly a beautifully modulated English voice filled the cockpit. "FM0570, good afternoon, squawk A55 and maintain FL140, cleared to Northold, standard routing, report over Lydd".

"Euh..., Roger...".

"What did he say"? asked the general.

"Euh ... it's OK, he has us under radar ...", replied Moustache.

After a while the British voice started again: "FM0570, did you squawk A55?" A short silence and then Moustache replied: "Euh ... Londone we are a Dassault three one too ...".

"FM0570, negative! Squawk, squawk A55!"

"55?"

"FM0570, is your transponder out of service?"

"Ah! Roger ... no problem ..."
Then he turned triumphally towards the general: "Their secondary radar is out of service!"

After further questions the London controller finally gave up and we continued our flight. About 30 minutes later we heard another disrupting call: "... descend to 5000 feet, QNH 997, call now Northold on 119,8. Good day!"

"Northold 119,8, thank you!" said Moustache.

Are you sure this was for us", asked the general.

Affirmative! We are going to Northold, aren't we?"

Upon switching to Northold we immediately heard another beautiful British voice: "... and turn right heading 050. You are under GCA control, do not answer my instructions, start descent with 600 feet per minute and reduce to 120 knots ..."

"Ah!" said Moustache, "a GCA".

"Ah!" said the general, "that I can follow, heading 050, 600 feet per minute, speed 120 knots!"

"OK now, you are intercepting the centreline, heading 080, you are on glide path".

"The runway is there!" said Moustache, "to the left!"

"Continue approach, increase your rate of descent, slightly above glide path..."

"What does this 'Roastbeef' tell us? We are already pretty low", said the general.

"Oh! You know the British!", said Moustache, "once I've seen an English controller of 16 years old! Would you believe..."

"No! Where?"

"In Cyprus in 1956".

"Continue approach, still too high, increase rate of descent ..."

"Still too high", complained the general, "he wants us below the electric power lines, ma parole!", then turning to Moustache: "I didn't know you were also in Cyprus, which squadron?"

"Euh, here is the threshold!", said Moustache.

"Ok, full flaps!"

Tchook! ... Tchook! ... said the tyres on the concrete.

Continue approach ... you are now on the glide path".

"On the glide path?", exploded the general, "but we have already landed!"

At the same moment a beautiful AVRO passed a couple of feet above us and landed less than 100 metres in front of us. "Merde!" exclaimed both the general and Moustache while punching the brakes.

"Northold, zeeze eeze Foxe Maike 0570, we have just zeen a plane landinge on the runnaway!"

"Ah! FM0570", replied the controller, good afternoon, maintain 5000 feet and report overhead for downwind runway 08. Yes, an AVRO just landed, what about it?"

The general then turned to Moustache: "What did he say?"

Opening Speech

by Jan Gordts *(President EGATS)*

Throughout the short history of EGATS we have endeavoured to suit our professional activities to the international and European nature of this association. For those not so familiar with our former initiatives I wish to remind our previous "Flow Control" and "Fuel Economy" forums. This time we have chosen a less spectacular but maybe more vital subject and in your responses to our questionnaire we have detected a genuine interest in R/T related subjects. We are therefore glad to welcome you during these two days in order to spend some time with the abstract as well as the practical aspects of R/T in aviation.

Whether we like it or not, the microphone and the headset (or loudspeaker for the less disciplined amongst us!) are the tools which enable steady communications between ground and aircraft, and though the voices may sound familiar, the faces sometimes are not! It is therefore essential that ground and air people meet on occasions like this one, be it only to discover the real faces corresponding to the anonymous voices on the VHF channels. That is, of course, if the industry cannot provide us with small videoscreens alongside the loudspeakers yet.

One of our motives, however, to choose R/T as a forum subject is the fact that we expect that the traditional voice communications in ATC may sooner or later become integrated in the magic world of new technology, so that our voices will become totally dehumanized and replaced by more efficient electronic data signals! In the meantime we live and work with the good old system and we want to make the best use of it, which means that we want to apply correct ICAO procedures, knowing that we can also make use of reliable equipment.

Whereas a discussion about procedures only could easily fill two forum days, we thought that the subject should equally be considered from the technical side and we find it very

rewarding to see that the specialized industry have taken a keen interest in our initiative.

Indeed, it will be our first forum in which operators and technicians will be able to contribute and though one might consider this as a test, we sincerely hope to provoke a real dialogue between pilots, technicians and controllers.

An Airline's Operational Experience in the Use of R/T -

by Mr Gerard Plukkel

(First Officer B747, KLM)

Radio Telephony.

"R/T - the vital link"?, or should I say "R/T, the link we would like to do without"?; the link to which extinction could better come soon? I think the sooner we come close to that goal, the better. The sooner R/T will only be a means of redundant communication, perhaps only in emergency situations, the safer aviation will become.

Historical developments.

Since ancient times man has invented and improved the means to make himself clear or communicate over long distances, far beyond physical reach of the person or persons at the receiving end. From the early smoke signals and the tomtom, to the primitive nineteenth century telegraph, via the loud-and-clear voice contacts between Houston and astronauts on the moon in the late sixties and early seventies, to the high speed data-links between present day communication centers, man has tried and succeeded in reaching "the guy at the other end".

Aviation obviously developed its own communication systems along generally the same line, though it may be too simple to compare the earlier signal lamps with smoke signals and the present day HF-radio with the tomtom. But in aviation we had our times with steady and flashing red, green and white lights and with wireless operators handling tapping keys. And ... we are still stuck with HF, being it single sideband nowadays, and with VHF, all far from hi-fi and with all the technical and especially human factors and shortcomings involved.

The weak link.

Means of communications in general and for aviation in particular, have improved drastically. But up till now, there has always been an important weak link; the human being. And in aviation R/T requires an almost one hundred per cent involvement of human beings. They control the techniques, they decide what to say and how to say it, using valuable time on the precious real estate of the radiospectrum. All in all

it is a very inefficient, imperfect method of exchanging messages. Besides, all this is done by people, who are concentrating on the performance of other quite tasking business like handling a jumbo jet or controlling a large number of aircraft in a small terminal area.

Words and phrases.

For the sake of simplicity care has been taken that words and phrases in R/T each have a distinct meaning, that their sound in pronunciation is clear in spite of all sorts of interference on the radiofrequencies used and that its phraseologies are as short as possible for a clear understanding. That seems to work, though still with all sorts of ups and downs. The changes in the phraseology last year did not help either, i.e. up till now, and although the ideas behind it are sound, it has not, or at least not yet, contributed to the conduct of better R/T.

Nowadays a mix of old and new phraseology plus all sorts of private inventions are used. A most striking example is the following exchange of messages of which I was a witness.

O'Hare Tower:

"KLM 612 into position and hold runway 32R"

which was read back by the pilot as:

"KLM 612 into position and wait runway 32R"

whereupon the controller replied:

"Negative KLM, I said into position and HOLD"!

Training and mistreatment.

Cockpit-crew members, as well as air traffic controllers, have been selected and trained for their job very carefully. One of the selection criteria certainly is the possession of a solid, reliable work discipline.

A pilot flies his aircraft to the book; standard operating procedures, standard calls, standard all and everything from crew briefings to checklist reading.

Controllers have their own, just as strict operating procedures, their own work manuals, their own check sessions.

Why then is it that R/T-procedures are so easily mistreated? Obviously, certain things learned during a training period fade from memory. But that is not the most important factor. Probably it is the fact that R/T is the only way to give some personal colour to a somtimes boringly standard operation. Maybe it relieves tension under sometimes stressfull working conditions. And maybe one just wants to be popular with the guy down below or up in the air. More certainty exists with respect to another human factor, i.e. selective listening. Instead of hearing what has really been said, one often tends to hear what one thinks or expects to hear.

In English speaking countries the own mother tongue tends to make non-standard phraseology easier to creep into the system. This certainly holds true for the United States, where nowadays so many non-standard calls clutter the frequencies, that one sometimes wonders what happened to ICAO- or FAA-standards.

Difficulties with the English language.

The same problem works the other way around. American and West-European pilots generally have a better command of the English language than for instance controllers in South-America, Asia or even Southern Europe.

So, as soon as a deviation from the standard phraseology occurs, the vital link is broken. A couple of years ago I visited the brand new approach control room and tower at Rio de Janeiro's Galeao Airport. Of all the controllers and assistants present, just one or two were able to converse in English; the others only just understood and spoke standard R/T-phraseology and I wonder what would happen if I had to explain to one of them that I was circling overhead with a double hydraulic failure.

Different languages.

Still a bigger problem in areas like Central- and South America and Southern Europe is the use of different languages in ATC. Flying from Amsterdam to Rome a pilot hears English, French and Italian speaking controllers and fellow-pilots in his earphones. From Amsterdam to Lisbon one hears English, French, Spanish and Portuguese. Let us not forget about what one hears overflying the Canadian province of Quebec.

I know of a pilot who always requested a translation of what was

said in a non-English language on the radio. But is that the way to operate? It is my opinion that the biggest mistake ever made in R/T-procedures is the allowance of a language other than English.

Trouble spots.

Day and night thousands and thousands of aircraft are criss-crossing this earth, from single-engine funplanes to the biggest and fastest jet aircraft.
Sometimes it seems that everything is well organised: the aircraft well-equipped, the personnel on the ground and in the air well trained, except for one thing: the communication part. And on top of that, the world is full of trouble spots, where even the basic communication requirements are not met.

For instance in Bombay, India, a single controller is handling near to a hundred widebody jets crossing the Bombay VOR every night East-, West-, North- and Southbound in the span of just an hour and a half to two hours.
The poor man has no radar facilities. Everybody is screaming for direct INS-routes, for an higher or lower altitude or for route diversions to circumnavigate a cumulonimbus.
And when that controller needs to call an aircraft, he usually has to call twice, because in that cacophony nobody seems to listen anymore. Luckily for the poor man the VHF-radioreceiver has its limits; a range of a mere 75 miles.

Blind Broadcast in Africa.

Over Africa amongst others, IATA-carriers years ago instituted a still valid blind broadcast procedure for en-route traffic, because great doubts existed about the quality of the AFTN like direct speech circuits. That procedure made sense to pilots because they had to operate HF-am and hardly had any contact at all.
Nowadays VHF-contacts make life easier for the piot and he tends to forget about the necessity of the blind broadcast procedure, although the African AFTN has hardly improved. The VHF-operating controller in Khartoum still is unable to talk directly to the VHF- and radar-equipped control room in Nairobi. And climbing out of Kano, Nigeria, northbound, a pilot has to call Niamy on HF to get an entry clearance, because Kano is unable to contact its adjacent control center.

The United States is an R/T-problem in itself for non-U.S. pilots, especially when operating in terminal areas. I can give you many examples, but will refrain from it now. A taperecording presented by a colleague of the Dutch Airline Pilots'Association will give you a striking example.

The probable cause.

Because of sloppy R/T, misunderstandings and language barriers, aircraft have landed on wrong runways, even on wrong airports; aircraft have met head-on at the same flight level and aircraft have not arrived at all. In almost every incident- or accident investigation, poor communication - lack of R/T-discipline - has been named as at least a contributing factor and sometimes even as the so called probable cause.

HF-SSB

HF-radio is still another misfortune. It is true that those of us with experience from the AM-era can say that SSB is a major improvement. But HF in itself does not fit in an age with high

performance jet aircraft in which direct contact with the controller is of utmost importance, in which a request for an altitude change should not take 40 minutes to be processed and answered and in which longitudinal separation of up to 175 miles is out of all proportions.

Stuck with R/T.

But for the present we are stuck with R/T as the primary means of communciation in aviation. And as long as we have to live with it we should cope with its operational problems by maintaining and improving the technical and procedural standards; and also by indoctrinating the personnel involved in the use of R/T, to stick to the basic rules and phraseologies.

The future: Data-link.

For the future R/T perhaps should be abolished altogether, except for emergency situations. Some means to do that are already available. In the United States the ARINC ACARS system is operational, reducing by more than 60 percent the R/T-part of the quite high volume of company radio traffic, the so called Airline Operational Control (AOC). Datalink by communication satellite should become the next step, in which aircraft on long range routes without radar surveillance at regular intervals automatically transmit their positions via satellite to an assigned control station. ATC-messages can be transmitted on the return link.

There should be no more erratic position report reading and read backs; no more time consuming discussions on the radio; no more waiting for a gap in the chatter an clutter to transmit a message.

Advantages of a data-link.

The advantages of a data-link can be numerous; just to mention a few:

* A dependent satellite communication surveillance system might have saved the 269 lives aboard KAL007 in September 1983; the notion that navigation satellites only could have helped here is not true; one communication satellite with data-link capability would have done the trick or could have.
* The separation over the North Atlantic and North Pacific can be reduced drastically, even to a point that so many aircraft would cross at almost the same time, that they would saturate the domestic ATC-system.
* Not only could the whole African airspace be controlled from one center, even outside Africa if necessary, but also many AFTN-problems would be solved with one dedicated communication satellite. Of course I realise that numerous political obstacles have to be taken in that regard.
* There would be no problems anymore with different languages.
* And the biggest of all: Much less R/T and much less direct and active involvement of human beings.

It may sound strange to start off a forum event that is named "R/T - the vital link" with quite another conclusion, but it is the only one I can come up with: "R/T - let's get rid of it as much and as soon as possible"!

Discussion....

Mr. Gillett, chairman of the panel, invited to open the discussion, to keep the emotions to the minimum and the facts to the maximum.

Mr. Fischer queried whether R/T would be eliminated completely and pointed out that the functions of the flight crew are related to other tasks. Whereas it is possible to train someone as to the technical operation of an aircraft, it should likely be possible to train good R/T phraseology.

Mr. Plukkel responded that pilots are trained according the standards and that they will apply standard phraseology. But experience has shown that one easily falls back to non-standard; after all, R/T is a means of human expression.

Captain Leonard explained that he was a member of the IFALPA ATS Study Group that had a considerable discussion on the new ICAO phraseology, culminating in the instructions to amend Annex 10. Still this new phraseology is not implemented worldwide, particularly in that part of the world which most deviates from ICAO, the United States. He asked whether the airlines themselves have done enough to publicize the changes that have taken place. To his knowledge both aircrews and controllers have not taken on board the new phraseology to a very great extent and still the same mistakes are being made, because the old phraseology is being used. In addition, Captain Leonard expressed his concern with respect to the incapability of certain controllers in various parts of the world to receive a message from a pilot experiencing an emergency.

Another matter for discussion was raised by Mr. Gillett: are we aware of the problems we have with procedures and phraseology? Mr. Rahmann had the opinion that there were only problems with non-phraseology. This view was supported by Captain Leonard; there are no problems as long as one uses the standard phraseology. In procedures and phraseology a compromise has been achieved, acceptable to both pilots and controllers. It is the implementation of the procedures which has to be tightened up. If we can achieve that we certainly come a long way to achieve safety!

Mr. van Hoogdalem remarked that R/T phraseology was boring in itself. On certain occasions one has to step aside from standard phraseology to draw the attention of the other party.

R/T, the Faltering Link -

by Mr H.M. Vermeulen *(VNV)*

Radio-telephony is a poor method of communication between parties, but -as with democracy- it is the best available under the circumstances of aviation. Yet in the light of the basic philosophy that governs aviation, whereby risks are scientifically investigated and reduced to acceptable numbers, it is a paradox that for a large -and worse: an increasing- amount, aviation relies heavily on communication by voice and ear.

The growing amount of errors induced by this sort of communication has never been subject of a complete investigation. We have improved in the technical field in small bits, apparently not with the intent of improving the quality of communication (i.e. elimination of misunderstandings) but with the intent of augmenting the quantity (more messages per time-unit) and thereby adding to the confusion.

Some technical problems like frequency blocking and overload are the subject of later presentations. Let me pause for a moment on the method of exchange of messages between two brains and let us not forget that the brain is the least understood part of the human body and no computer has been made with a shadow of the capabilities of the human brain. Perhaps fortunate, because we need some sort of certainty in life.

Since the curse of Babel was upon us, we struggle with thousands of different languages. But even before that time we have been uanble to exactly translate what goes on in our brain. To

compensate we use body-language, face-expression and we explain what we do not mean to give the other party the opportunity to pick out another choice. The worst habit, however, is that we say things completely wrong and most of the time we are understood in spite of that. If, however, we have to translate these controversies into another language, as many of us have to do, then the problems of understanding are suddenly multiplied.

A further complication is that countries have different laws, in spite of the commendable efforts of ICAO. This means that certain phrases have a legal meaning which is not understood by foreigners. To give a daily example: when we are cleared for a visual approach in the United States, it means that we are not separated from other traffic, that we do not get wake turbulence separation, that we do not get a warning of the ILS not being on standard, etc... These things are not known by most pilots. We may get information -given with the best intentions- which confuses the pilot, like: "watch for wake-turbulence". I once started immediately a 360 turn on final to the dismay of the controller, who told me after I responded to his query that I had 6 miles separation. Why then the warning? Is the pilot supposed to do something with the information or not?

It is obvious that the use of R/T gives the users a great disadvantage over face to face conversation, while an international aspect adds further to the misleading of the brain.

While communicating, both parties must strive towards clarity with the least possible words; we must assume that both parties have the same goal. This last necessity may lead to another unwanted though frequently appearing syndrome, resulting in the fact that we often hear what we want to hear and see what the brain suggests there is (selective hearing as referred to by Mr. Plukkel). An example is a controller telling the pilot that there is a trimotor, 11 o'clock, 3½ miles. The pilot, seeing a speck in that region affirms and the controller assumes that the pilot will take care of his separation. This is a most dangerous situation on several counts:

1. Most people do not realise what a human being can detect at a distance of 6,5 km (3½ NM). Certainly not whether it is a trimotor or which company it is.
2. There is no way a pilot can assess distances with his eyes through lack of background.
3. It is assumed that a pilot has nothing else to do but to look outside and enjoy the scenery.
4. It is also -wrongly- assumed that, once in sight, the subject remains in sight.

We must realise that there is a difference between a radar screen with mode C and the human eye directed by the human brain. Both, the pilot and the controller frequently talk about two different targets while each assumes that it is the same. The pilot lacks the secondary mode.

ICAO, already struggling with the problem that officially there is no agreed common language - though I must admit that I have always been understood with some form of English all over the world, be it with different delays- has tried to bring some order in the chaos. But it is like a bowl of rice: statistically several grains must be pointing in the same direction, however, I am not able to find them .

Urged by States, operators and users ICAO finally agreed to review outdated Annexes. A Secretarial Study Group started on 14th May, 1979, and it took 60 months before the amendments to Annex 10 and the PANS/RAC became applicable. It cannot be denied that improvements were made, but it is still a mystery why a radar controller has to ask the pilot whether his gear is down and locked, while he has some four different warnings in the cockpit for that occurence and none for a too low approach speed (which kills people).

Let us take a little time to look at their ultimate wisdom, it is deserved because it does not happen very often that lawbreakers make the law. A rather considerable change in philosophy took place almost unnoticed: the basic introduction of the "ATC-instruction". By paradox there is no definition of the term 'instruction' being published, but you have noticed that the use of the word CLEARANCE and CLEARED has been restricted to very few occasions, e.g. take-off, landing, approach and airway clearance. Start up, taxi, line up, climb or descent are no longer clearances, but instructions. Instruction, of course, to make things perfectly clear, that can be refused to be carried out by the pilot.

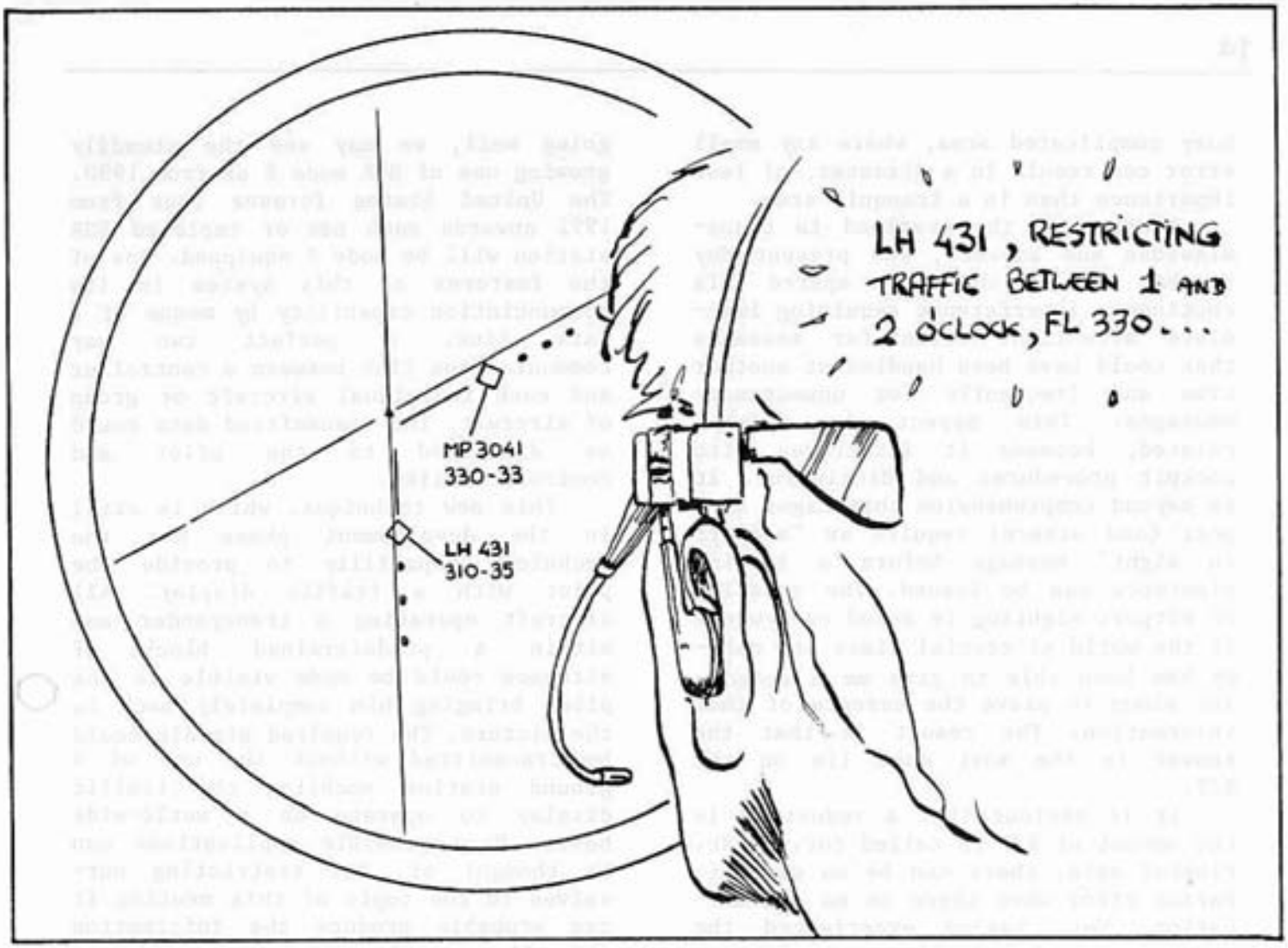
The review of the phraseologies was based on being clear, concise and unambiguous..... a rather difficult task, particularly in the English language. The result is that today for overshooting you GO AROUND and when you go around you have to MAKE ANOTHER CIRCUIT. When you are READY FOR DEPARTURE you cannot be cleared for departure, but you are CLEARED FOR TAKE-OFF.

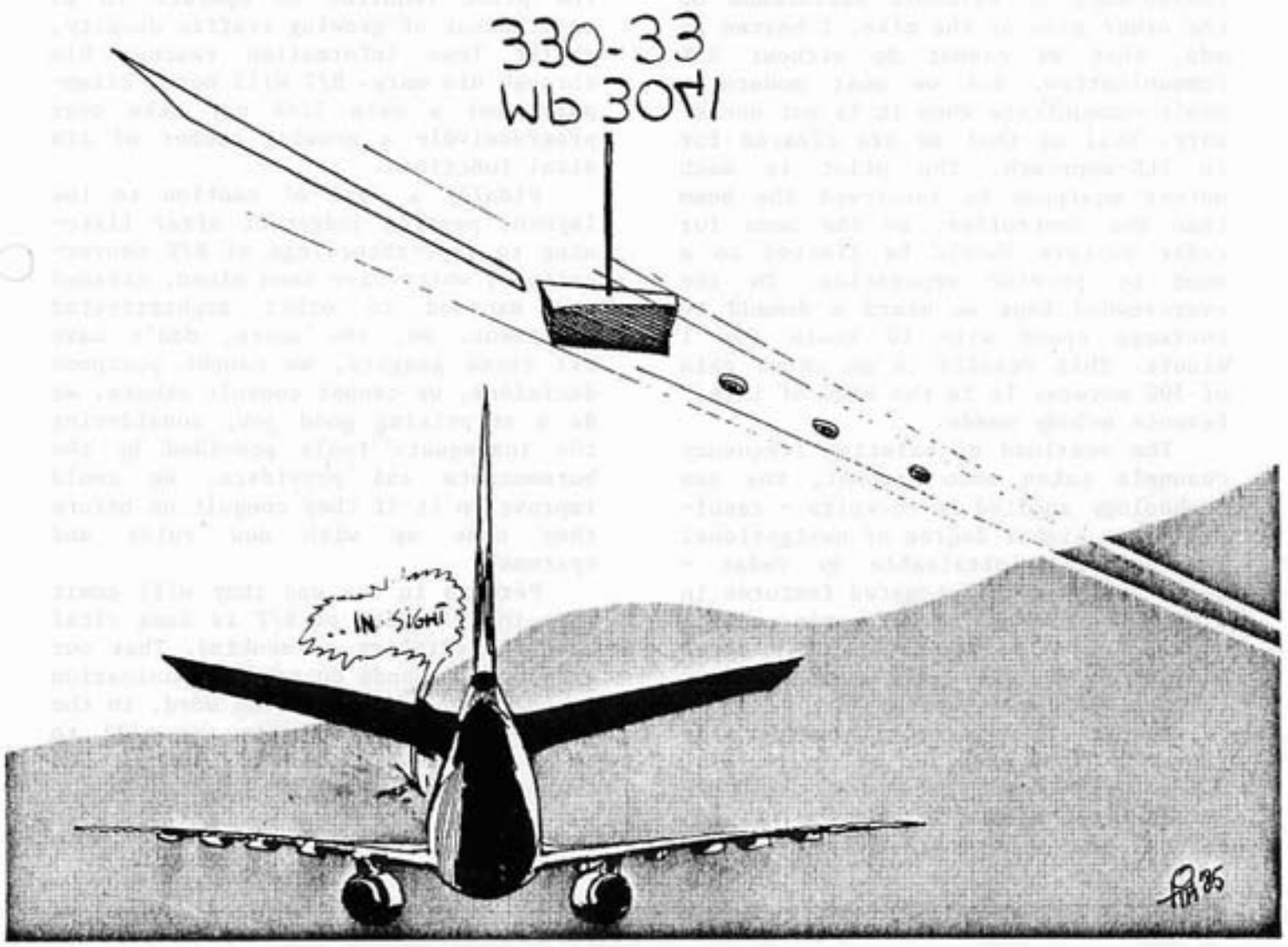
Misunderstandings in given clearances, instructions and other messages are rather frequent. On both sides the "receive what you expect to hear syndrome" has been a cause of many accidents. This is particularly true when the language is pronounced in a peculiar way and the absurdity that some air traffic officers seem to think that the pronunciation is improved by talking faster, thereby putting the horse behind the cart. This product of ICAO is certainly an improvement, though it will take several years before there is a worldwide use. However, it covers only a part of the communication.

Making a full list of all the weak spots in R/T will take too much of our time. We are all familiar with call sign confusion, the use of several frequencies by one controller covering and transmitting on different sector frequencies, the complete inadequacy of the use of HF-frequencies and the coupled absurdity to have a pilot-communicator link instead of a pilot-controller link. In the present technological era it is inexcusable that there are still no plans for a worldwide VHF-coverage. It is even worse that large parts of the world have, in theory, an ATS-system of some sort, but in fact these systems do not function and aircraft operate in environments without record of their movements at all, let alone some form of order. The only ones worrying about that are the pilots. The rest seems to think that if you don't react to obvious problems, they go away. I particularly mention the largest part of Africa, the Indian Ocean and parts of the Far East.

It is perhaps significant that forums as this one take place in areas where the only problem seems to be the increase of traffic. It seems that well organised bodies worry about small dark spots and refinement of their system rather than improvement. That is a comfortable position. But the pilot is like a highly sophisticated man equipped with electric shaver, toothbrush and calculator suddenly -without warning- thrown in a dark jungle and expected to function equally perfect. He is even not supposed to take any extra fuel. It makes one wonder about the logic of mankind.

The question comes up repeatedly: what can be done to improve the inadequate method of interference in flights of machines worth the equivalent of a large factory. Quite a few measures are so obvious, which is perhaps the reason why they have not been implemented as yet. But certain impopular measures have to be taken. It is clear to everyone that in an area like Chicago insistence upon read-back procedures will result in a lower acceptance rate, unless the capacity is increased by adding parallel runways. But how often can you do that. Or is a read-back in a


LH 431, RESTRICTING TRAFFIC BETWEEN 1 AND 2 OCLOCK, FL 330...
MP 3041
330-33
LH 431
310-35


330-33
WB 3071
...IN SIGHT

busy complicated area, where any small error can result in a disaster, of less importance than in a tranquil area.

Apart from the overload in transmissions and answers, the present day two-man cockpit should be spared this continuous interference requiring immediate attention. Often for messages that could have been handled at another time and frequently for unnecessary messages. This aspect is safety-related, because it interferes with cockpit procedures and discipline. It is beyond comprehension that Lagos airport (and others) require an "airport in sight" message before a landing clearance can be issued. The question of airport sighting is asked everywhere in the world at crucial times and nobody has been able to give me a reason, let alone to prove the essence of that information. The result is that the answer is the most used lie on the R/T.

It is obvious that a reduction in the amount of R/T is called for. As Mr. Plukkel said, there can be no communication error when there is no communication. Yet, having experienced the reassurance of valuable assistance on the other side of the mike, I hasten to add, that we cannot do without R/T communication. But we must moderate. Don't communicate when it is not necessary. Tell us that we are cleared for an ILS-approach. The pilot is much better equipped to intercept the beam than the controller, so the need for radar vectors should be limited to a need to provide separation. In the overcrowded tape we heard a demand to increase speed with 10 knots for 1 minute. This results in an extra gain of 300 meters. It is the kind of interference nobody needs.

The overload of existing frequency channels taken into account, the new technology applied in cockpits - resulting in a higher degree of navigational accuracy than obtainable by radar - augmented by more automated features in ATC as for example an automatic control on maintained flight level and cleared flight level, will make most standard telephony calls superfluous.

Tomorrow's technology considers an improved SSR system and if the trials, which are now conducted in the Eurocontrol Member States (U.K. and France) and in the United States, are going well, we may see the steadily growing use of SSR mode S as from 1990. The United States foresee that from 1992 onwards each new or replaced SSR station will be mode S equipped. One of the features of this system is its communciation capability by means of a data link. A perfect two way communication link between a controller and each individual aircraft or group of aircraft. The transmitted data could be displayed to the pilot and controller alike.

This new technique, which is still in the development phase has the technical capability to provide the pilot with a traffic display. All aircraft operating a transponder and within a predetermined block of airspace could be made visible to the pilot bringing him completely back in the picture. The required signals could be transmitted without the use of a ground station enabling the traffic display to operate on a world-wide basis. Many possible applications can be thought of, but restricting ourselves to the topic of this meeting it can probably produce the information the pilot requires to operate in an environment of growing traffic density, whilst less information reaches him through his ears. R/T will never disappear, but a data link may take over progressively a growing number of its vital functions.

Finally a word of caution to the laymen, passing judgement after listening to tape-recordings of R/T conversations, which have been mixed, cleaned and exposed to other sophisticated treatment. We, the users, don't have all these gadgets, we cannot postpone decisions, we cannot consult others. We do a surprising good job, considering the inadequate tools provided by the bureaucrats and providers. We could improve on it if they consult us before they come up with new rules and systems.

Perhaps in the end they will admit that the vitality of R/T is less vital than the vitality of mankind. That our existence depends on good communication in the widest sense of the word, in the desire to understand, in the will to help, the inclination to forgive and the need to care.

Discussion....

Quoting Churchill Mr. Gillett remarked: "the United States and Great Britain are two great countries divided by one common language". This was quite well illustrated by a sample of what you can hear in the cockpit. An actual tape recording (Chicago), provided as an introduction to the speech of Captain Vermeulen, highlighted the difficulties we usually encounter when we try to communicate.

Mr. Ralston commented that air traffic controllers labour under the necessity to put questions. Although it is understood that R/T - time could be used to a better extent, one is legally obliged at some stage to confirm the Mode C read out for example. In reply Captain Vermeulen said that there is no legal ground for reporting the runway in sight. You can loose sight the next moment; it only means that you had the runway in sight five seconds ago.

With respect to a device which could possibly limit a transmission to 15 seconds and thereafter automatically cut out the transmission, it was generally felt that such technical limitations should not be made.

Unanimously one agreed that only one language should be used for communication. Mr. Arcangeletti pointed out that it was recommended that the ATC centre decides on the language to be used. Long term ICAO policy, however, is directed towards the implementation of English (a slow process though!).

Mr. Gillett reported that once a check captain was advised never to ask for a repeat clearance; he therefore instructs his pilots not to ask for a repeat clearance. For once and for all this misconception was corrected: if any pilot, at any time, anywhere, is in any doubt about the contents of an ATC clearance, he should request a clarification.

Headset Hardware -

by Mr John McNaughton

(Clement Clarke International Ltd.)

This presentation is to give some general outlines of the considerations taken when designing and developing a general purpose headset suitable for use with Air Traffic Control Systems and other uses.

A headset has a special aspect in that it is a piece of equipment which is worn by the user and because of this, special demands are made on the design which are not common to other equipment. A headset is not designed for a particular user, rather the users requirements are taken into account when designing a headset. This may sound confusing but certain parameters are common to all users and this set of basic requirements becomes the basic headset configuration.

For example, by and large a headset user requires two-way communication. Incoming information is received through the ears and outgoing communication is transmitted by voice through the mouth. This dictates that it is sensible to have the receivers (or receiver) close to the ears and the

microphone close to the mouth. It is well known that the population have infinitely variable facial features and so it is necessary to make these positions adjustable without too much difficulty. There must also be a supply lead to the headset. Add to this the requirement that the headset must sit on the head without external means of support and that the user must have freedom of head movement and vision and the basic parameters of the product are established.

Now we can consider specific user requirements. What are the major requirements of the user, particularly in Air Traffic Control? Although all the following factors are important, we will consider some more deeply than others as they may not be so obvious.

1. Wearer comfort.

This is reasonably obvious. Any user who wears a headset for long periods knows that even minor discomforts will eventually lead to extreme annoyance. This affects the performance of the user and may alienate him from the product. Specifically, it is important to avoid excessive pressure of the receiver housings around the ear. This is a common complaint in high attenuation headsets (ear defender types), but in lighter headsets less tension is needed in order to retain the headset in position. Also, contact of the ear lobes with the inside of the receiver housing is irritating. Large and inflexible downleads (which usually connect to one earshell) can restrict head movement or cause the headset to move on the head.

Earpad pressure, then, should be adequate to retain the shells in a position over the ear and yet not too great to cause discomfort. The earshells should have large comfortable pads which adequately clear the earlobes or, alternatively, sit on the ears. The shell itself should be able to swivel to accomodate the varying contours of the side of the head. The microphone should be easily accessible in front of the mouth, and once set in position should stay there until forcibly moved by hand.

2. Light weight.

Of course, the lighter the headset, the better. This factor is an extension of wearer comfort. Most headsets are manufactured mainly in injection moulded plastic. However, where special requirements need to be met - such as high ambient noise attenuation - this can sometimes require heavier construction. For a general purpose headset, however, weight should be kept to a minimum.

3. Ambient attenuation.

The reason for attenuating ambient noise is to ensure that the received information, the signal, is intelligable and clear and not confused with other audible noise. However, it is not right to demand that every headset has the highest possible ambient noise attenuation. There are two major reasons for this. Firstly, high noise reduction can give a feeling of isolation and repression, particularly when the user is subjected to the condition for long periods, and this can affect the users mental condition and performance. Secondly, on occasions, the wearer requires to hear external communications from audible warnings or from his colleagues. Under these circumstances high attenuation type headsets would require the user to be shouted at and subsequently to remove at least one earshell in order to hear properly. It follows then, that a judgement needs to be made on the amount (if any) of ambient noise attenuation required.

Generally, ambient noise attenuation is expressed in dB's. To evaluate attenuation a noise is generated of known strength and frequency and a signal received from a sensor (a microphone) usually coupled to an artificial ear. Then the earshell/housing is placed over the sensor with a sealing force of approximately 0,5 kg and with the same level of ambient noise the sensor output is again measured. The difference of the two readings is obviously due to the earshell attenuation.

There are other attenuation tests which are more subjective (ASA 224.22 etc... BS 5108 1974) and yield more detailed results if this is needed. Generally, though, the comparison method has proved adequate for general purpose headsets. A "white noise" test (noise comprising of all frequencies across the audible spectrum at

approximately equal energy levels) is also useful.

What determines the ability of an earshell to attenuate noise? Generally it is a combination of shape, construction, materials and mass. An earshell will conduct and resonate easily its own natural frequency and harmonics of this frequency. The first objective then, is to determine which frequencies one does not want to be transmitted through the shell (for example, on military aircraft 400 Hz could be a prevalent component of ambient noise). By stiffening the construction (by using more rigid material, or introducing ribs into the shell) the dominant natural frequency is raised. However, a complex construction may conceivably have more than one natural frequency as one particular area of the shell behaves differently to another. Calculations become complex and there is an element of art and luck in arriving at a good shell which meets requirements.

Noise emanating from a source is propagated in spherical waves. If these waves strike a surface whose curvature is similar to the wavefront, the energy transmitted to the surface is large. Hence it is sensible to avoid gentle concave outside curves on an earshell, and restrict the shape to convex curves. Thankfully, the functions of an earshell lends itself easily to this requirement. Reflection of sonic energy compliments absorption in achieving noise attenuation. Greater amounts of material will not only stiffen the construction, but enable more energy to be absorbed. However, serious consideration must be given to the weight aspect. Combinations of materials can reduce noise transmission dramatically, but here again, weight and cost are restricting factors.

All these considerations are made when designing the earshell, which is possibly the most obviously influential component to the user.

4. Cost.

Gross cost, which includes development and sales cost as well as material, component and production costs, is not the single most important factor considered when designing a quality headset. True, costs should be kept to a minimum and value analysis is carried out throughout the design process. But final specification and quality should not be sacrificed solely on grounds of cost.

There is some truth (though not total truth) in the adage that "one gets what one pays for". Unfortunately, very often it is not the end user who buys a headset, but sometimes his supplies officer. Perhaps it could be said that purchase costs are more important to finance-orientated managers than to users, but emphasis should be put on the purchaser that low price could mean greater cost in the long run - through shorter life, more costly service and possibly reduced user performance.

5. Reliability.

An extremely important consideration. This aspect of the product cannot be totally divorced from performance. The very existence of bodies such as the F.A.A. and C.A.A. are testament to the importance placed by users on quality and reliability. And rightly so.

Headsets for any use, if they are to be classed as quality products, must at least meet the minimum requirements of those bodies governing the users. Some designers still regard these bodies and their certifications as hinderances. In fact they are aids to the designers and manufacturers, and certification of a headset is assurance that it has been extensively type-tested to rigid specification.

6. Serviceability.

Generally speaking, serviceability is a secondary consideration, but important none the less. If a headset has been well designed and well made then servicing requirements are generally minimal. However, expensive items which cannot be serviced are costly to replace, so it is evident that serviceability and replacement of components should be made as simple as possible without adversely affecting the other more important aspects described previously and subsequently.

7. Appearance.

Appearance, although important, must be of secondary priority. The performance and ergonomics of the headset must not be compromised because of appearance. However, users will much prefer to wear (and to be seen to wear) an attractive headset rather than some ugly, functional beast. Although a headset is a basic product with little scope for innovation, a clever designer can deliver a product which is aesthetically pleasing and attractive to the user. A good looking product will always create a good initial impression both with the purchaser and the user which helps in the subsequent user environment.

8. Performance.

Performance is of primary importance. If any headset does not perform well then it is not a good headset. What constitutes good performance? Good performance is satisfying the needs of the user in the way the user requires. Requirements vary greatly from user to user. In broadcasting, for example, speech audio quality is essential. In helicopters and in high noise ground use, noise reduction both at the earshells and at the microphone is essential.

Usually, a headset will consist of two receivers, one for each ear, and one microphone. The receivers and microphone must be electrically and acoustically compatible with the equipment on which it is used. Because of the varying requirements and environments, and also the different types of radio equipment, it follows that there are available several different uses and environments.

MICROPHONES.

We will consider five commonly used types of microphone:

a) Balanced armature:
In this type of microphone the armature is moved by the diaphragm in a permanent magnetic field. Its frequency response is rising sharply from the lower frequencies with a broad peak falling off sharply in the higher frequencies. Noise cancelling is moderate.

b) Moving iron (magnetic):
Similar to the balanced armature in principle but generally with one field coil instead of two. Usually the frequency response is similar to the balanced armature except that the peak is sharper around the mid-frequencies (1KHz - 2KHz). The noise cancelling characteristics of these two mics is assisted by the fact that the response is poor at either ends of the acoustic spectrum. Sensitivity (output levels) and "speech quality" is relatively poor.

c) Moiving coil microphone:
This microphone has much flatter response over the speech range (greater dynamic range). Hence sensitivity and "speech quality" is good. Construction is more intricate and hence the cost is higher.

d) Electret mic (Condenser mic):
Generally this type of microphone has a higher electrical impedance than those previously mentioned. This microphone has a flat response over an increased range. The sensitivity is comparatively high and "speech quality" is usually excellent. They can be made very small but good quality microphones of this type tend to be expensive. Noise cancelling range is extended.

It is not subject to magnetic interference, so magnetic screens are not normally required.

e) Carbon microphone:
This type of microphone consists of carbon granules in a container which is attached to the diaphragm. This diaphragm resonates in sympathy with the voice signal and compresses the carbon granules. The effect of this is to increase and decrease the resistance to a supplied direct current. Very early principle but still in use with some refinements. It has very low cost and its output is high but its "speech quality" is poor. Distortion is relatively high, thermal noise (granules arcing) can be present, granule packing can be unpredictable and can vary. Noise cancelling is very effective. Noise cancelling is achieved generally by equalising sound (noise) pressure levels either side of the diaphragm so that only wanted signals are picked up.

Receivers.

Receivers convert electrical energy into acoustic energy (the opposite of microphones) and the mechanical process is reversible. Hence earphone receivers can be used as microphones, although it is impractical to use microphones as earphones for several reasons.

Normally ear receivers are of the rocking armature type. These are reliable, robust and strong; but response is limited up to approximately 3.5 KHz. This will adequately cover the speech range. Moving coil type earphones have improved response but can be less robust and reliable under harsch conditions. This situation, however, is improving.

All the above components which consist the headset must be matched in impedance to the equipment on which it is being used.

Summary.

Ultimately, the designer is merely the conveyer of the users wishes. These wishes, needs and wants become the essential bare bones of the product specification to which the designer works. No product is worthwhile unless the users buy it and they will not buy it if it does not meet their needs.

It is imperative, therefore, that you, the user, state clearly your requirements and preferences; and where necessary your criticisms of existing systems. The manufacturer will always listen and incorporate dominant user observations in continually developing products, leading inevitably to a closer harmony between user and equipment.

Deficiencies in R/T - The ATC Viewpoint

by Mr "Edge" Green *(GATCO)*

I am supposed to be talking about the wrongs of R/T today. Now if I was talking about call sign confusion or the use of frequency separation I might find it a lot easier, because, I believe, that it's the techniques that are used rather than the actual words, that are more often at fault. We have all heard the garble, the gabble and the clipped transmissions that have led to misunderstandings or confusion.

Before I talk about the current situation I ought to mention my interest in this subject and my background. Before I got involved in ATC, I was a user/receiver, having been civil aircrew for ten years. I clearly remember ICAO waltzing between Juliet and Jig and back to Juliet in the mid-fifties. In the early sixties I worked for the USAF and learnt that a 'roller' was the same as a 'touch and go' and then joined the Ministry where I discovered an 'overshoot' was the same as a 'go around'. I was now a user/transmitter!

My interest was really sparked when I started to represent IFATCA on the IFALPA ATS Study Group. I discovered there that pilots and controllers

really did want to understand each other and that both organisations had very similar objectives. All credit to IFALPA who took the lead and organised a tripartite working group consisting of IATA, practising pilots and controllers. The idea was that in the face of a concerted approach by the three organisations, ICAO would have to listen to what we were all saying. In fact about this time ICAO was beginning to realise that something had to be done to try and sort out the chaos that was creeping in all round the world. Unfortunately the tragedy of Tenerife occurred, perhaps due in some part to a hint of R/T confusion? Too late to help those unfortunate victims but not to try and get some standardisation into the system.

It became apparent to ICAO that in 1977 the size of the task was such that it could not be completed for the expanded Annexes 2 and 11 about to be issued.

Accordingly, on 15 December, 1977, the Air Navigation Commission (86-26) agreed to include in the ANCP a new separate task concerning RTF phraseologies.

The European Air Navigation Planning Group (EANPG) at its Eleventh Meeting in October 1978 reviewed those aspects of RTF phraseology associated with missed approach, as a consequence of which it became apparent that there were other areas causing concern to pilots and that the present arrangement for the publication of RTF procedures and phraseologies in a number of ICAO documents was not a satisfactory one. The relevant section of the EANPG/11 Report reads as follows:

"DEFICIENCIES IN RADIOTELEPHONY PROCEDURES

Regarding the question of radiotelephony mentioned, the Group had before it a paper presented by the United Kingdom Member which outlined difficulties that had been encountered, both by operators and air traffic controllers because of present ambiguities in the phraseology to be used in case of a missed approach.

In dealing with this subject, the Group was advised of the fact that it was already intended to inscribe the entire subject of radiotelephony procedures in the work programme of the Air Navigation Commission. It was also noted that the case quoted in the paper of the United Kingdom Member was not the only point causing concern to pilots, operators and ATC; and for this reason the subject of radiotelephony was at present being studied actively by IATA and IFALPA, the latter with contributions from IFATCA".

The review of the specific difficulties encountered with radiotelephony procedures related to missed approaches, rapidly revealed that the EANPG would not be in a position to make any specific contribution to this subject because of its evident worldwide implications, both from the point of view of languages used in aviation and habits of both pilots and controllers. It was, however, found that, when dealing with the subject of radiotelephony within ICAO, it would be desirable, for safety reasons, to give priority consideration to radiotelephony procedures related to the taxiing, take-off, approach and landing of aircraft because of experience had shown that ambiguities in the language used by both pilots and controllers

during these stages of flight could have the most serious consequences.

In addition, the EANPG also noted that the present arrangement for the publication of ICAO provisions relating to radiotelephony procedures were not the most satisfactory ones (distribution over a number of ICAO documents, etc...), and although some phraseology was specified for controllers no effort had so far been made to develop phraseology to be used by pilots to cover at least the more routine communications to be made by them. This latter aspect was felt to be particularly important with the continuing growth of IGA operations and the problems posed by some pilots engaged in such operations and having only limited experience in the use of radiotelephony.

Finally, the Group felt that, in the intervening period until ICAO had completed its work on this subject, it would be useful to draw States'attention to this matter, requesting them:

(a) to pay particular attention to it during training of both pilots and controllers:
and
(b) where necessary, to review their existing provisions in this respect, drawing on the experience gained by other States as appropriate.

As a result of the deliberations the following conclusion was reached.

CONCLUSION 11/28: REVIEW OF RADIOTELEPHONY PROCEDURES

That:

(a) ICAO undertake, as a matter of urgency, a complete review of the existing provisions regarding radiotelephony with a view to eliminating existing ambiguity and developing a standard phraseology for use by both pilots and ground personnel;
(b) in undertaking work mentioned in (a) above, ICAO give priority to the development of those aspects of radiotelephony procedures related to taxiing, take-off, approach and landing of aircraft.
(c) in conducting this work, ICAO seek to obtain fullest cooperation from representative user organisations in order to ensure that daily practical experience is reflected in the work;
and
(d) consideration be given to the development of a self-contained manual on radiotelephony procedures addressed to both pilots and controllers and covering all aspects relevant to the use of radiotelephony (operating practices, composition of messages and their formulation)!

On 19 October 1978, the Air Navigation Commission (89-8) noted the EANPG Conclusion and requested the Secretary to study the method by which a review of the air-ground radiotelephony provisions, including phraseologies, called for in the Conclusion should be undertaken. The description of the ANCP Task referred to above was subsequently modified to read:

"Review and updating of the air-ground radiotelephony provisions including phraseologies, in relevant ICAO documents with a view to eliminating existing ambiguities and developing a more comprehensive set of standard phrases for use by pilots and ground personnel".

Invitations to send an expert were sent to the Czechoslovak Socialist Republic, France, Japan, Spain, Switzerland, Union of Soviet Socialist Republics, United Kingdom and United States, together with the International Council of Aircraft Owners' and Pilots'Associations (IAOPA), the International Air Transport

Association (IATA), the International Federation of Air Line Pilots'Associations (FALPA) and the International Federation of Air Traffic Controllers' Associations (IFATCA).

Czechoslovakia failed to contribute and the USSR contributed through existing ICAO staff; otherwise everyone else responded.

The Study Group started work in 1979 and reviewed most of the material in PANS-RAC and Annex 11 and as I represented IFATCA throughout this period I can share the blame or credit for the standardisation of 'Go-around' or 'Affirm' or the introduction of 'vacate' which as you all know was brought in last November - some five years after the Study Group started work!!

Just a little bit now about how that Study Group worked. Most of the useful contributions that were made in the Study Group were made by practising controllers or pilots, the daily users of R/T. We were also the people that identified some of the then current problems. A significant exception to this was the USA whose FAA representative tended to look in the Manual to see what the correct phraseology should have been, rather than what was currently being used. Even after all this work the FAA failed to meet the common implementation date. Whilst I appreciate that even now there are quite a lot of 'Americanisms' in current R/T a FAA representative with more recent experience would have ensured, such useful items as 'radar contact' and 'pilots discretion' could have been incorporated into everyday use. For me it was a great opportunity lost.

Of course the Study Group's recommendations had to go through the Air Navigation Commission (ANC) and I regret to say that whilst they were prepared to accept 'willy nilly' complicated technical specifications when it came to R/T phraseology, a subject they could all understand, they all became instant R/T experts! They debated at length much of the ground we had already covered, often coming to the opposite conclusion to the one reached by the Study Group! The representative of the United Kingdom (a former colleague of mine) was propably the worst offender - persuading the ANC to reinsert the phrase 'Go Ahead' in place of the Study Group's 'Pass your message' in spite of the fact that we had documented hundreds of airfield incidents caused by this term. Another example was the loss of the word 'hundred' which the Study Group tried to introduce. I cannot see any reason why it should not be possible to refer to 3500 ft, as "Three five hundred..."! From my point of view, when using 500 foot levels, this would be very helpful. One always seems to be extremely busy when the Met-report contains several cloud groups at odd levels. Hundreds would help out, if only to minimise the risk of muscular spasms in the jaw after reading the tenth 'zero' out. Seriously, I cannot see that it is a word which could be easily confused with any other, and would have welcomed the chance to use it. I am afraid every day we still hear twentyfive hundred transmitted as an altitude.

These are still deficiencies that we are left with and still need tidying up.

Interestingly, much of the R/T discussions revolved around other definitions, for example when do you call long final, final or short final - I suppose a lot depends on the aircraft you're flying. The outer marker is probably long final for the Cessna and short final for Concorde!

Whilst I appreciate that many will not like words like 'vacate' or 'affirm' they are really no more than code words similar to 'squawk' and have specific meanings to aviation orientated personnel. I have to say that 'line up and wait' is my current unfavourite phrase but it is better than 'line up and hold' which in Japanese always came out as 'line up and roll!' Incidentally the Study Group recommended 'line-up' without any trimmings, 'and wait' was another ANC insertion.

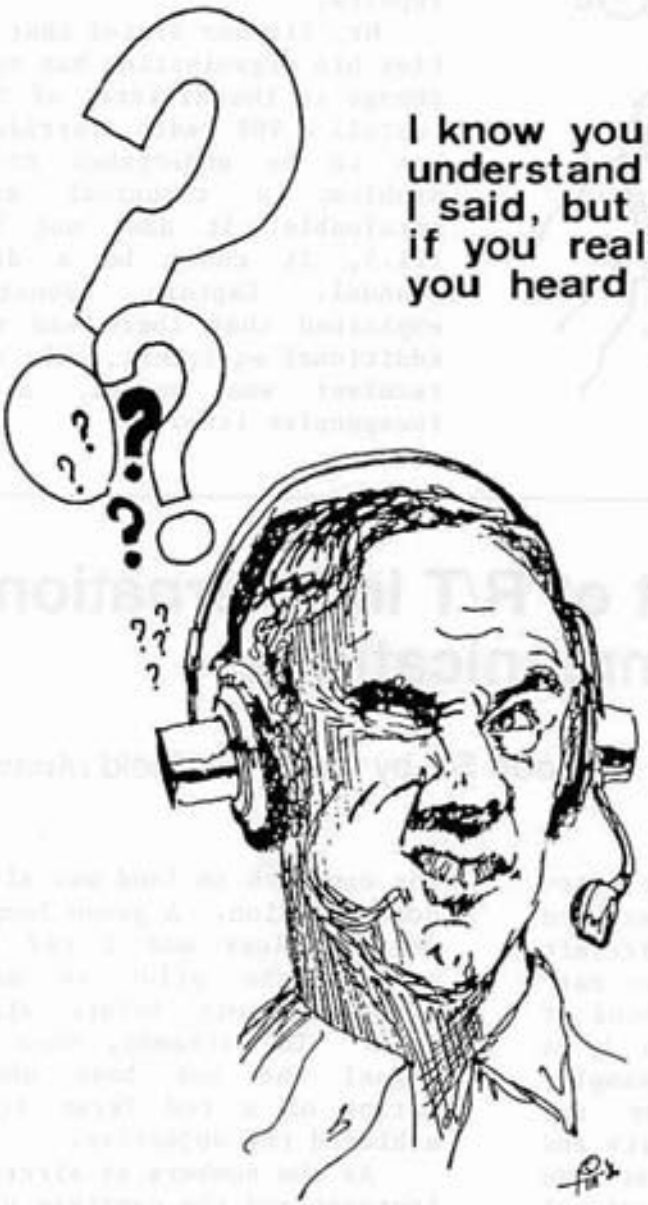
From world-wide reaction to the so-called new phraseology most has been favourable with one or two notable exceptions. I believe South Africa is very much opposed to much of the new phraseology.

It was particularly difficult for the group to make a decision on whether to support 'go around' or 'overshoot'. The group opted for 'go around' because there was evidence that it was gaining favour and well over 50% were already

using it. It was alo particularly favoured by the pilots'organisations. Perhaps of more significance was that the group was unanimous in its opinion that whether it was 'go around' or 'overshoot' there should only be one phrase.

In my opinion the worst phraseology apart from 'go ahead' is now the conditional clearances used in aerodromes such as 'SK 941 behind the landing DC9 line up behind'. I agree it's very untidy but if we had not adopted this phrase then we would probably have lost it altogether as IFALPA was bitterly opposed to any conditional clearances believing that they were inherrently unsafe.

To conclude I do not believe that we have too many deficiencies left. The words themselves must be clear, concise and unambiguous. Most important of all standardisation world-wide is essential. If we have a deficiency it is the failure of ICAO to make phraseology a "standard" and for them to insist that States comply or file a difference. Don't let's have another Tenerife before further action takes place.



Discussion....

The question whether one considers that the emergency frequency 121.5 or 243.0 should be used in the event of loss of contact on normal civil ATC channels resulted in many reactions. According to Mr. Rahmann 121.5 was used for other purposes, not for emergencies. It was therefore impossible to monitor the normal frequency correctly if listening to 121.5 as well.

Captain Leonard fully sympathized with the idea of improper use of 121.5. ICAO states that 121.5 shall be monitored in certain designated areas, specifically unpopulated areas such as deserts and over oceans. It is also recommended that 121.5 should be monitored at other times when the equipment of the aircraft so permits. Within IFALPA it was concluded to recommend that it should always be monitored at other times; the equipment of aircraft should not be a limitation to allow the monitoring of 121.5. It was Captain Leonard's opinion that airline training procedures should be amended in that 121.5 shall be selected on the second set, whenever this set is not used for company communication or weather reports.

Mr. Fischer stated that in the sixties his organisation has recommended a change to the Ministry of Transport to install a VHF radio override. Something has to be undertaken to solve the problem; a technical solution is attainable. It does not have to be 121.5, it could be a discrete air channel. Captain Leonard further explained that there was no need for additional equipment, only a single VHF receiver was needed, a small and inexpensive item.

The Development of R/T in International Aeronautical Communications -

From Morse to Mode S - by Mr Arnold Field *(Aviation Consultant)*

In the early days of the development of aviation no requirement existed for communication between the aircraft and a ground station. Flying was carried out within sight of the ground or water, and information required by a pilot was mainly visual. For example, navigation was carried out by the observation of well-known landmarks and the direction of landing at an aerodrome was judged either from visual observation of a windsock or a white letter T displayed in a signals square. The approach to land was also by visual communication. A green lamp signal was an all clear and a red lamp signal advised the pilot to make another visual circuit before attempting to land. In extremes, when a red lamp signal had not been observed, the firing of a red Verey light usually achieved the objective.

As the numbers of aircraft began to increase and the carriage of passengers began to become a practical method of transport, the need arose for a method

of communication between the air and the ground, which had a greater range of understanding and would provide a safer means of passing intelligence than was possible by visual means alone.

The first of these methods was the use of wireless telegraphy, which required the carriage in the aircraft of a wireless operator and similarly wireless operators on the ground, at the various locations concerned with communication with particular flights. Messages were passed between the aircraft and the ground using the Morse code. Letters of the alphabet were formed by using a series of dots and dashes, following the long-established practice used by seaborne vessels. The letters so formed used an international grouping known as the 'Q' code. They were usually in groups of three letters and their decode was in accordance with an internationally agreed format. The decode had the virtue that the written interpretation could be expressed in any language, provided the translation conformed to the agreed decode.

The 'Q' code employed a wide range of aviation expressions and the addition of the letters IMI to a transmitted code or group of codes indicated they were interrogative, thus the same code group could be used for question and answer. For example, an aircraft which required a course to fly to reach a specific location, would transmit the following message to a particular W/T ground station, 'QDM IMI', which when decoded meant:

> Will you indicate the magnetic heading for me to steer towards you with no wind.

An example reply would be in the form QDM 090 1030 - which decoded meant:

> The magnetic heading for you to steer to reach me with no wind was 090 degrees at 1030 hours.

This then was a relatively simple and unambiguous method of international communication albeit with a somewhat limited vocabulary.

Two major events, however, in the development of aviation have combined to outdate wireless telegraphy and the Q code as an effective method of communication, other than for use over very long distances, which are at present beyond the range of the frequencies used for voice transmissions, or in some of the more remote parts of the world. The two events are:

1. the speed of the vehicle being communicated with (the aircraft), and
2. the dramatic increase in the numbers involved.

To try to put this rapid expansion into some sort of perspective, from a 'need to communicate' point of view, it would, I think, assist to refer briefly to the development of aviation.

Prior to the advent of the Second World War, aviation in Europe was very much in its formulative stage. From a civil point of view air traffic, as a means of communication, was not only expensive but was still being undertaken in a pioneering spirit, and from a military aspect the use of aircraft in a defensive and offensive role, as a major weapon of war, had still to be proved, despite the lessons of aerial bombardment learnt in the Spanish Civil War. Only on the continent of North America had the potential of the use of aircraft as a rapid means of communication advanced to a stage where regulation of aircraft flights prompted the need for intervention by a ground organisation to assist in the safety and economy of operations.

The events of the Second World War, however, led to a dramatic exploitation of the use of aircraft, not only as a defensive and offensive weapon, but also as a means of rapid transportation. Following the cessation of hostilities this expansion continued, particularly in the role of civilian passenger-carrying aircraft, which became used increasingly for commerce and also for pleasure purposes.

Equally rapid was the expansion in the sophistication and performance characteristics of both civil and military aircraft, resulting in the fact that today the mix of air traffic varies from the light executive aircraft cruising at 160 knots to the wide-bodied jet transport cruising at 500 knots, and supersonic transport and fighter aircraft flying at Mach 1 plus. Additionally, these aircraft, even in the field of civil aviation, can vary in the climb and descent performance from rates of 500 feet per minute to rates in excess of 5000 feet per minute.

To try to give some idea of the number of aircraft involved in this equation, for example, at the present time the London Air Traffic Control Centre handles more than 3500 aircraft movements a day, over half of which are climbing and descending in the congested airspace around London. Heathrow Airport, the busiest international airport in the world, is used by 70 different airlines and for the greater part of the day has at least one aircraft landing or taking off every minute. Even on the broad waters of the North Atlantic Ocean some 500 aircraft cross each day to and from the North American continent.

To channel this flow of air traffic, and to obtain the necessary degree of orderliness to separate them one from another, requires the application of the complex set of rules and procedures. It is not the purpose of this presentation, however, to spell out the complicated art of controlling air traffic which is dealt with elsewhere, but to refer to it only in the context of the need to 'communicate' for at present, all of the sophisticated aids at an air traffic control officer's disposal finally result in the use of a speech circuit to issue an executive instruction to the pilot of an aircraft, for the safeguarding of his flight.

It was therefore the urgent need for direct speech between the pilot and the controller, rather than through a wireless operator, which resulted in the use of radio telephony for voice communications and the abandonment of wireless telegraphy and the 'Q' Code, other than in those areas to which I have previously referred.

It was, however, clear that as aviation had progressed beyond national boundaries, was rapidly developing both economically and geographically on a world-wide basis, and was by its very nature dependent upon the highest level of safety, any speech to be used had to be unambiguous and clearly understood by the mix of nationalities who could be present in any particular airspace at any specific time. A further inexorable factor in speech understanding was that aviation was happening, was rapidly expanding, and would not wait upon lengthy world-wide debate of well-intentioned sectional interests.

In recognition of the fact that the growth of aviation would promote a wide variety of problems, in addition to international communication, a Convention on International Civil Aviation was held in Chicago (U.S.A.) in 1944. As a result of this meeting of world-wide aviation interests an organisation was established, called the Provisional International Civil Aviation Organisation (PICAO). Later, following the ratification of the Convention, the organisation became the International Civil Aviation Organisation (ICAO) and today has a world-wide membership ranging from the U.S.A. to the U.S.S.R. and from Iceland to Japan.

The organisation works by consent through committees and it is a matter for the concerned participating states to adopt the deliberations of these committees, by inclusion of them in their national operating manuals, or, if appropriate in air legislation.

It was then this body, ICAO, who applied itself to the task of introducing for aviation a world-wide method

of standard speech communciation, to be adopted in all airspaces used by international flights. In doing so three main factors had to be recognised:

1. the language used had to be common;
2. the pronunciation of words had to be common;
3. a set of phraseologies had to be compiled to cover as many as possible of the standard communications essential to control the flights of aircraft, taking off, en-route, landing, and moving on the surface of aerodromes.

In regard to the language to be used it is possibly an historic accident that a form of English provided the basis of the standard phraseologies. It has to be remembered, however, that the U.S.A. even before 1945 had, due to its economic growth and great geographical distances, promoted the use of aviation as a means of rapid transport, and in doing so, had not only developed the techniques for the control of air traffic, but had been using voice communication via a network of company radio frequencies for the issue of control instructions over long distances. Also amongst the greater part of the world's nations who were emerging as potential aviation users, the English language was undoubtedly the one most commonly understood. It was therefore possibly a case of common sense and expediency rather than design which resulted in the use of English.

With regard to pronunciation and word spelling, an alphabet was devised which was designated, as far as possible, to cater for the difficulties experienced by speakers other than native English. For example, the word 'hotel' loses its aspirate and is pronounced 'otel'. Another example is the word 'Quebec' which when pronounced in accordance with the phonetic alphabet becomes 'Keybeck'. Thus a genuine attempt was made to try to cater for difficulties in pronunciation in those areas where known problems existed.

The standard phraseologies themselves were designed to be as simple as possible within the constraints of a very technical subject, and had to be particularly phrased to try to eliminate any ambiguity. In this regard they have to be submitted to continuing review; not only to prevent any liability to misinterpretation, but also to keep pace with the changing situation resulting from technological growth. An essential element of this common usage language is this continuing review, and for aviation purposes this is carried out by one of the working groups of ICAO which comprises foreign nationals and representatives of the users; that is the pilots and the air traffic control officers. International agreement is only reached after long periods of time. It is not perfect, but it works.

The success of this use of a common method of communication for world-wide aeronautical purposes can, it is suggested, be attributed to four main causes.

1. The need to safeguard human life – the closing speeds of modern aircraft can be likened to the velocity of a bullet out of a rifle, approximately 1000 miles an hour. Therefore when this is related to the three-dimensional spider's web of air traffic, it

will be readily apparent that there must be, as far as is reasonably possible, no ambiguity in the verbal messages which are exchanged between the ground and the air.

2. The economic factor - the rapid expansion, in particular of commercial aviation, would undoubtedly have been severely inhibited in its growth without the existence of a ground organisation capable of ensuring the safety and expedition of air movements. A basic requirement of such an organisation is the capability to relay, rapidly, intelligence in written and verbal form, across the boundaries of separate languages.
3. The lack of sectional interests - it is tactfully suggested that a well-intentioned concern for the preservation of the grammatical structure of a particular language often inhibits the development of a common method of communication. The urgency of the requirement to provide a solution for the safety and expedition of world-wide aviation meant that sectional academic interests and champions of particular languages, became a secondary consideration.
4. The use of an existing language - by general consent it was decided to use an existing language as the basis for aviation communications. Historically and geographically a form of English was the language most commonly in use on an international basis, and therefore urgency and common sense conspired to confirm its application.

It is considered that the success of the adoption of a common international language for aviation, was due to the will to succeed, abetted by the fact that safety of human life and commercial expediency were paramount to the bustling growth of air transport and the fact that a permanent international body, the International Civil Aviation Organisation, was in existence, for debate on agreement by consent.

New methods of communication, particularly between the air and the ground, will doubtless be advanced with the advent of modern technology. And indeed, as mentioned earlier this afternoon, the exploitation of SSR for this purpose is already well advanced. SSR as you know permits an aircraft to be interrogated and information to be obtained without recourse to the use of R/T speech circuits. Presently information obtained from the aircraft's transponder in this manner is generally limited to the aircraft's identity and the height at which it is flying.

However, because this facility exists it is also capable of being exploited for other forms of two-way intelligence. You will undoubtedly have heard of the term mode S. The S stands for selective and in the context in which we are considering its application, it acts as a data link between the aircraft and the ground. As its name implies aircraft carrying this Mode S transponder can be contacted individually without other aircraft being involved, which of course is not the case when R/T is used. In other words the aircraft has an automatic private line via the Mode S transponder to the ground station computer and therefore information can be exchanged by data transmissions rather than by speech circuit. I should mention that, to be effective, the selective addressing of the aircraft in this manner requires the application of a different technique of interrogation of the aircraft transponder.

It will be clear that such a method of air-ground communication opens up wide horizons, which are not necessarily limited to air traffic control. However, whatever form these communications may take, it is considered vital that the principle of a world-wide standard format, and the symbols and phrases to be used, follow a similar forum of international agreement as has been the case with radio telephony.

Discussion....

Generally it was felt that it would be impossible to replace the voice link. Mr. Rahmann remarked that the vital link has proven safe despite its failures! The question of replacement is only a valid one, when something else has proven very effective. Data link has not yet developed to a degree of safety equal to R/T.

Mr. Domogala said that a lot was mentioned about mode S; it is particularly promoted by the FAA and the operational target date is 1990 - 1995. But, taking a close look at world developments, one can be lucky when a radar will be available in Greece by 1990 - and everyone is flying to Greece these days - and in Chaad one expects a VHF transmitter not before 1988.

Captain Vermeulen reminded that data-link is to come, although he is not entirely happy with it. If a controller in his instructions to the pilot increases the pitch of his voice, this cannot be seen on a display. However, it would be of interest to send operational flight information via data-link; voice communication is to be applied for messages which require direct compliance.

The Influence of Noise at Work -

by Dr Marius Stekelenburg *(Occupational Health Officer)*

Sound is conducted through the ear-canal, the ear-drum and the ear-bones into the cochlea where sensitive hearcells change vibrations into nerve stimuli. These hear-cells ar very important and vulnerable to loud noise. When you have to stay in a noise environment for a long time and the noise exceeds the 80 dB limit, the hear-cells may be damaged and part of the hearing may be lost for ever. In other words, noise induced hearing loss can be expected if noise exceeds during a long time the 80 dB limit.

Young and healthy individuals already hear sounds with a pressure of 20 microPa. or more, whereas noise becomes painful at a pressure of 100,000,000 microPa. or more. I don't think that you have such sophisticated equipment in the cockpit, but we all have it in our head. As it is difficult to treat a scale which goes up to 100,000,000 microPa., we use a logarithmic scale (dBs). A typewriter produces a noise of 60 dB, a car 80 dB which is 60 times the noise generated by a typewriter.

Young and healthy individuals can hear sounds with a frequency between 20 and 20,000 Hz. When the person gets older this scale is narrowed.

The speech frequencies extend from 200 - 6,000 Hz. The Dutch telephone company for example uses frequencies between 300 and 3,400 Hz.

The result of a hearing test is expressed in an audiogram. On most occasions the initial noise induced hearing loss is found at 4,000 Hz. Other frequencies are involved too in case of progressive hearing loss. To obtain an impression of the possible noise induced hearing loss, the threshold shifts are clustered after correction of the expected age related hearing loss. Hearing losses are generally not caused by noise, when 50% of the individuals have no hearing loss after application of this correction. If the average hearing loss at 2,000 and 4,000 Hz is 45 dB or more, there is a good chance that difficulties in speech understanding arise.

Sound stimuli are conducted by the cochlear nerve into the brain stem. In this way noise may influence the autonomic system, the hormonal system and the vigilance. So, different reactions of e.g. heart and stomach may provide an indication that people are submitted to noise.

Work load can be expressed in three models:

1. Classic model, workload versus taxability. This model cannot be used when you have to work with your mind.
2. Cybernetic model, feed-back system. This model indicates the optimal workload; underload and overload need correction.
3. Stress model, adaptation system. ("war economy"). Usually you have to do much more than you can. Such a situation cannot last long and will otherwise cause strain and mental or physical exhaustion.

Concentration at work can be explained by the cybernetic model; it depends on the noise level, the noise quality, the task quality, the character of the subject (introvert/extrovert, A-type/B-type, IQ) and other mental load. Noise may increase the mental performance by stimulating the vigilance of individuals with a high IQ. Too much noise and noise with disturbing qualities result in a decrease of the mental performance.

Communication doesn't depend only on the noise exposure level, but also on the quality of speech and amplification, the position of the speaker, the vigilance of the listener, familiarity with the subject matter, familiarity with the language, the quality of hearing and the use of ear protection.

Telephone can be used satisfactory at noise levels up to 60 dB; communication is satisfactory at noise levels up to 85 dB. That doesn't mean that you can hear everything. The brain has quite some memory and need not hear very much of a sentence to fill up the rest and to know what has been said. If we take a test for example with foolish words, you will be able to repeat 95% of the words with a noise level of 60 dB. When the noise level increases to 70 dB only 5% of the words can be repeated, although the other 95% will be investigated by your brain. Most of the times this works very good, but sometimes not! One thinks that one has understood the message, while one has only made an interpretation which may be wrong!

Stress at work calls for automatic reactions of the body. We can distinguish the following reflexes:

1. Novelty reflex. Head and eyes point at the source of sound; the hearing threshold is reduced.
2. Startle reflex, e.g. short closure of the eyes.
3. Alarm reaction (stress model). Elevation of the diastolic blood-pressure, increase of the heart-rate, structure of the bloodvessels, increase of the metabolism, reduction of perfusion and peristaltic waves of the gastro-intestinal tract, increase of the tension of the striated muscles and dilatation of the pupils. At long term this may result in mental disturbances and an elevation of the blood pressure.

Aircraft Calling -

by Captain Denis Leonard *(Dan Air Services)*

There is a story of a farmer who had a mule which wouldn't work unless he was quite severely urged on with a big stick. His next door neighbour had a mule which seemed to work almost by telepathy, certainly by nothing more than a simple word of encouragement. The first farmer came to his neighbour and said: "can you train my mule to work that way"? So they went up to the first farmer's farm-yard, where the mule was standing and the neighbour picked-up a huge balk of timber, went up to the mule and with his full strength struck the mule on top of the head, knocked him to his knees. The farmer protested vigorously and said: "I thought you could train my mule without beating him". The neighbour answered: "Ok, certainly I can, but I've got to attract his attention first"!

The aircraft call sign to the pilot is a means of attracting his attention when it comes to his headset. And it is a very important function when he is performing other tasks on the aeroplane. We hope we don't have to be struck with a large balk of timber. We also hope that the words which come through our headsets will attract our attention in a sensible manner and allow us to carry on with our normal tasks at other times, when it is not necessary for us to have our attention in the headset.

Today's paper was presented at a meeting of the United Kingdom Flight Safety Committee, 10th May 1983, later printed in the BALPA "Log" and reprinted in the "ICAO Bulletin". The author was nominated by IFALPA to participate in the ICAO Study Group for the Elimination of Ambiguities in Radiotelephony Call Signs (EARC).

In recent times an accident was narrowly avoided at a major European airport when two aircraft with similar call signs lined up at opposite ends of the same runway in poor visibility. On that particular occasion luck was sufficient to stop the take off of a jet aeroplance while it was still on the runway so that it did not collide with a smaller aircraft at the other end. No one was hurt. But in 1982, luck ran out and there was a notifiable accident in which a passenger was seriously injured when the call sign of a departing DC10 was mixed up with a similar flight number of another operator.

Concern about misidentification is not actually new. Air traffic grew at a very fast rate following the second world war, particularly with the advent of the jet aeroplane, and with that growth came the sophisticated system of Air Traffic Control in which one could no longer file a flight plan just thirty minutes before departure and expect an instant and unrestricted clearance. The effect of that change on airline operators meant that they could no longer use the registration letters of the aeroplane for flight planning purposes and the flight number became the prime means of identification both for commercial purposes and in the air.

The transition from the old familiar system to these new numbers was not easy. Controllers knew many of the regular call signs as particular types of aeroplane and also knew many of the pilots who flew them. The new flight numbers were not popular and soon gave rise to problems. By 1966 these problems had reached such a level that France wrote to ICAO saying that the orderly operation of ATC was threat-

ened. The COM/OPS Divisional Meeting in that year called for some action to be taken but no real solutions were offered and the call sign confusions got worse. In 1968 the flight plan system was amended to facilitate the introduction of the repetitive flight plan and the use of flight numbers became even more difficult to drop because they were at that time the only form of identification known sufficiently in advance of the departure. That fact itself lead to even more use of numbers.

In 1972, a pilot in what was then British European Airways, suggested that the letters of the ICAO phonetic alphabet, being more distinctive sounding than the numerals, could be used as a direct replacement for the flight numbers using all twenty six so that a call sign containing the company designator followed by three letters could produce up to 17,576 identifications, far more than the 9999 by the use of four decimal digits. The flight number would be retained for commercial purposes and the alphabetic equivalent used for ATC only.

That idea was studied by the COM Study Group of the British Airline Pilots Association and found to have much to commend it, but also two significant defects. First, a two letter designator followed by three other letters would in many cases be identical to a civil registration marking, for example DABEC. Unless that could be overcome, the proposal could go no further. The solution was to place an extra character, a single numeral, in the call sign so as to give it a distinctive appearance and sound (e.g. Dan Air BRAVO FOUR ECHO CHARLIE).

The second point was that the letters of a call sign equivalent to a particular flight number for one company would also be used for the same flight number by other airlines so that the similarity would simply be tansferred into the new system and identical numbers would still produce identical call signs. This problem was considerably reduced by giving airlines different codes, deleting from the alphabet the letters of the company designator. The effectiveness of this solution will be seen later.

With these two difficulties resolved the scheme seemed workable. A further development offered itself with the choice of the single numeral. Although the prime purpose of the numeral was to split up the string of alphabetic characters, the numeral itself could be used to give additional information. At first the thinking was that since the most call sign confusions had been observed on the domestic services of BEA, the numeral could be the first of the four digits of the flight number indicating the route being flown. The controller on the Study Group thought that would be unnecessary and rather restrictive if the system was to be used to its full potential outside the United Kingdom. A better use would be to indicate some of the characteristics or performance of the aeroplane itself, including the wake turbulence category of jet aircraft.

Having settled the details, the next step was to try it out. It had been proposed as a solution to a problem particularly affecting BEA and the Air Traffic Services office of the airline welcomed the suggestion but unfortunately the operations section was not interested. Dan Air, also with scheduled domestic services, was interested and let it be known that from 4th October, 1972, those flights would operate with the new alpha-numeric call signs. Up to that time the company had managed to file standard flight plans using aircraft registration call signs and was strongly resisting pressure to enter the stored plan system with flight numbers. On that Wednesday afternoon, the first flight departed from Leeds to Glasgow as Dan Air BRAVO THREE TANGO FOXTROT and returned as TANGO GOLF. Other services joined the next day and for four days the system seemed to work well in the air and with ATC, but on the administrative side it was evident that not enough information had been passed out in advance and the trial was halted for that to be sorted out.

During the following years airline traffic grew even more rapidly and Dan Air actually doubled in size. The problems in BEA were at last recognised but still there was no acceptance of the alpha-numeric form, rather an attempt was made to use a hybrid system

in which the second digit of the flight number was deleted and an equivalent suffix letter added.

As a system it was far from adequate and created as many difficulties as it solved, so after a run of six months it also was dropped. A further attempt to revive the full alpha-numeric trial was vetoed by the National Air Traffic Services on the ground that unless BEA took part, the results would be of little value. It was suggested that an exercise in the ATC simulator would prove the same points as a flight trial with greater safety, but time on the simulator would not be available for another three years. The programming of a computer to examine the call sign similarities of scheduled flights in Europe alone was estimated then to cost over $ 150,000 without count being taken of the rapidly growing charter traffic.

It was quite obvious that if any progress was to be made, some hard facts and figures would have to be produced to show just how great was the problem and how well would the alpha-numeric system reduce it, if at all. At that time the United Kingdom had introduced the Mandatory Occurrence Reporting system (MOR) and among the first inputs were several cases of hazardous call sign confusions. Research which BALPA had started in 1972 was expanded and with the assistance of IFALPA Member Associations, data were collected also from outside Europe. Even before this collection was completed, ICAO had heard of the project and asked for details through IFALPA. The mounting evidence showed clearly that there was indeed a serious situation and that the alpha-numeric proposal had a very good chance of resolving it, but there was a reluctance to get ICAO involved until the actual extent of the problem and its solution had been fully evaluated by analysis of the evidence. It was apparent that in the noisy environment of the flight deck and with even only slight distortion by the R/T, many of the numerals were being misheard and that flight numbers which seemed clear enough on paper were easily confused coming through a headset either in flight or on the ground.

The main part of the research was conducted by aircrew writing down every call sign as they heard it on a control frequency, the times of joining the sector and leaving it. After five years, some 8,000 call signs had been noted on nearly 1,500 ATC sectors, most of them in Europe. On many of these sectors the observation was not complete either because the observer had to discontinue before the aircraft left the frequency or because one or more call signs were missed or could not properly be identified. These sectors were discarded and the final analysis was made of nearly 5,000 call signs on 800 sectors.

Obviously the problem of call sign confusion would be reduced roughly by one half if half of the airlines used the alphabetic form instead of flight numbers, but it would be necessary to determine what would be the result if all the flight numbers were converted to the new form. The first results confirmed the problem. In the flight number form on an average airways sector in Europe, an observer could find one potential call sign confusion every seventy five minutes. With all identifications converted into an alphabetic

form, the potential was reduced dramatically to only one in every one thousand one hundred and fourteen minutes, an improvement of over 14:1. If some flight numbers were retained the reduction in actual confusions should be much better than 90%. Unless there had been some gross inaccuracies in the survey, the potential superiority of the system was clearly confirmed as sufficient to justify its introduction at least on a trial basis.

In 1978, with this evidence available, IFALPA was ready to present the case to ICAO. The Air Navigation Commission requested the Secretariat to establish a Study Group and after two years of correspondence, the Group met in Montreal in November 1980. The Group members were Russia, Japan, France, Netherlands, United Kingdom, IATA, IFALPA and IFATCA, although France did not attend the meeting and Russia has made no input of any kind. The United Kingdom was by then fully supporting the proposal. The recommendations at the end of the meeting were that the system should be tried out in a simulator and if found satisfactory there, then also in flight by one or more airlines. The Group would also examine the other existing forms of call signs and if appropriate, draft an amendment for inclusion in Annex 10. Such a draft amendment has now been proposed. The review of the other call sign forms has not been completed but may be necessary before 1987 when all airline designators will become three letter groups.

The simulator exercise sponsored by ICAO was conducted at Ottawa in January 1981, observed by representatives of ICAO, IFATCA and IFALPA. The object was to show whether the new call signs would be usable in modern ATC systems under intensive workload. The flight number to call sign conversion was made in the computer of the simulator using a program in FORTRAN supplied by IFALPA and adapted with a COBOL interface routine. After only a very short time it was obvious that the controllers and pilots were having little or no difficulty with the new call signs either on their own or when mixed with numbers and the way was clear for a larger in-flight trial which Dan Air commenced on February 18th, 1982.

Cathay Pacific was also showing interest in participation, but the main difficulty was that the new form was not yet incorporated into ICAO procedures and so could not be used on international flights without the consent of the States overflown. Dan Air obtained that consent from Ireland and The Netherlands but France did not reply to the requests. Without France, the trial could not be extended to include the popular routes into Switzerland, Spain, Portugal and the Canary Islands, which would also permit the participation of several other British operators and those from Northern Europe. Brymon Airways were ready to join in the trial from November 1982 but hindered by the refusal of the British Airports Authority to accept these flights at Heathrow, apparently under the impression that this new form would give them the same problems they found with two other non standard forms used by British Airways Shuttle and British Airtours in which random selection of letters in the call signs were not predictable by any simple mathematical process and therefore not so compatible with the airport computer systems without very expensive software changes. In fact the full alphanumeric is easily handled by computers because of its mathematical base and there is already a substantial amount of software available in different computer languages.

The German Authorities and Controllers'Association decided to carry out their own simulation. Most regrettably there was no consultation in advance and the exercise conducted in Munich was not witnessed by ICAO or IFALPA. The report which followed as in several respects contradictory to the results of the Ottawa simulation and to the flight trials, but the report also described the content and schedule of the exercise which would have been almost impossible in reality and a most questionable introduction to a new system or test of its validity. It did agree with the Ottawa observation that where call sign similarities exist in any form, confusion does follow.

In April 1983, another trial commenced in South Africa following preparations in which material supplied by Dan Air was used. In that trial,

there was a much higher proportion of traffic using alphabetic call signs including several aircraft registrations and there was a very significant reduction in similarities shown.

Out of all this have come some simple facts.

1. Call sign similarities cause confusion which can be lethal.
2. If the similarities are reduced, the potential for confusion is reduced and indiscipline becomes less significant.
3. Most of the objections to the proposal before the trial started were speculation which has not been supported by the results.
4. The alpha-numeric is usable, though the extent of trial so far is too limited by non operational factors to give results with statistical validity.

The trial phase is now over and the future of the project lies with ICAO and the airlines. If the decision is taken to proceed with it, the ground work has mostly been done and there will be little cost involved.

Appreciation must be expressed of the help and co-operation of Dan Air and its staff at all levels, and of the close liaison with the controllers through their Guild.

A Flight Identification System for Air Traffic

by Mr Michel Thivant *(Air Inter)*

Purpose and historical background.

The automation of air traffic services enables the storage of various data framing the flight plan whose reference is the flight identification. This identification through the flight number itself is undeniably profitable because of its invariability; however, this system creates some important problems to the executive office in charge of the air traffic control. The increasing number of airlines using this system causes similarity of codes to appear. Consequently, confusion and errors are more frequent.

Improvements brought by our airline in 1975, quickly turned out to be insufficient. This improvement consisted in the addition of one letter to the flight number. The SCTA (Service du Contrôle du Trafic Aérien), well aware of these problems, willing to solve them, urged the French airlines to cooperate in order to work out a system which would remove all confusion in flight identification. In late 1976, AIR INTER put forward to the SCTA a new system which we named "BIGRAM OF IDENTIFICATION". This new system is simple and most flexible.

During 1977, after various simulations, it was adopted by the French Administration and allowed to be used experimentally on all French domestic flights operated either by regional airlines or by state authorities and important companies (i.e. the Army, the Aerospatiale, etc...). The international airlines, AF and UTA were excluded; such a system could not be used outside the national borders. In 1978, this system was finally adopted.

THE METHOD.

Description:

The flight identification as a whole is given by the airline code and the last three digits of the flight number to which another two-letter-code, known as bigram of identification, is added.

Example : IT 433 BC.

The bigrams of identification are composed of two letters of the alphabet excluding the vowels I and O, as well as the two-letter-codes used either to designate the French carriers or to identify means of radionavigation (except ILS).

Example : AA-AC-AE etc...

This system allows about 450 possibilities.

The bigrams of identification are allocated by the SCTA according to the number of daily flights and to the

maximum number of flights during each airline's most crucial peak hour. The bigrams do not follow a logical pattern (from AA to AZ) but are attributed in an aleatory manner (AA, MZ, SP, etc...) avoiding the use of opposite bigrams for the same airline (AB and BA for example). The allocation of bigrams is divided into two categories: one for scheduled flights (regular bigrams) and one dedicated to a daily ponctual use (JOKER bigram).

Taking into account one movement every three minutes, we can expect, after a certain period of time, to find a similar bigram according to the number of possibilities given to the airline.

For example :
- for 24 possibilities return after IH12 (AA to AZ),
- for 48 possibilities return after 2H24 (AA to BZ),
- for 150 possibilities return after 7H30 (AA to GF).

It is important to note that the number of bigrams allocated to the carriers is neither cumulative in case of regroupment, nor interchangeable. The STCA is is the competent authority which studies each case, according to the criteria listed above.

Practical use:

A bigram is added to each flight number corresponding to all commercial flights operated within national borders, including Corsica; scheduled, supplementary and charter flights as well as non-scheduled and positioning flights. THE BIGRAM IS ALWAYS LINKED WITH ITS ALLOCATED FLIGHT NUMBER regardless any modification which might occur to the flight itself except for a delay over 5 hours (AIR INTER). Technical and training flights are still identified by the national registration system (e.g. F.BUAL).

a) The stored scheduled flights (RPL) are alloted a "regular" bigram according to a computerized classification method.

b) The flight preparation office is given a number of "JOKER" bigrams, which they use most efficiently for supplementary, charter and non-scheduled flights and also positioning aircraft and flights with important delays. These codes last as long as the duration of the flight and can be reused after flight closure.

Example : supplementary flight IT 8434 will be identified as IT 434 BL; BL being the JOKER bigram.

Particularities.

1. Who is in charge of adding a bigram to a flight number?

Always the carrier operating the flight. The airline is bound to provide the crew with the bigram(s) to be used, in due time (at least 2 hours) by the most appropriate means (message or note). In all cases, information is sent to the departing terminal and to the duty manager of the airline operating the aircraft on a regular basis. If the information is given by message, the full code with the phonetical repetition of the bigram will have to be mentioned.

Example : IT 8335/IT335 CU Charlie Uniform.

2. Very important delays:

RPL: If the delay is over 5 hours (AIR INTER), the RPL is cancelled and a FPL is transmitted using a JOKER bigram as identification.

FPL: We are careful not to take the JOKER bigram already used on the delayed flight; the same rule is adopted for a scheduled flight.

3. In case of diversion (FPL):

The original bigram is still linked with the flight number except when the delay is over 5 hours (AIR INTER). In this case a JOKER bigram is used.

4. Informing the Crew when using a FPL:

The simplest way to inform the crew is to hand over the copy of the FPL to them before departure; thus, the departing terminal has to be the addressee.

5. Identification for air traffic:

a) by means of 7 figures, for example: IT 532 RD. This code fully appears on the air traffic messages and on the controllers'strips.

b) the visualization on the radar screens is provided by a label with the simplified identification: for example: IT-RD.

c) radiotelephonic conversations comply with the following rules:

- use of the bigram identifying the airline corresponding to a phonetical code, then, on the first call the flight number and last the bigram of

identification.
Example: the flight IT 532 RD, on the first contact on a frequency will be called "AIR INTER 532 ROMEO DELTA".
Then, when it remains on the same frequency, a simplified code "IT RD" can be used which is announced "AIR INTER ROMEO DELTA". To avoid confusion, the controller may insist upon the permanent use of the full code.

CONCLUSIONS.

This system does not claim to be the ideal solution to all flight identification problems. It has, nevertheless, the obvious advantage to increase security, avoiding the confusions which the nine numerical possibilities have led to so far. In addition, this system allows a sufficient period of time to elapse between two flights which might have the same final bigram. With AIR INTER, our 150 possibilities enable us to re-use the same code after a five-hour-interval only and following a very different flight number.

Moreover, a computarized program enables us to allocate the most suitable regular bigrams in relation with each flight route, so that the last letter of the bigram cannot be used before a reasonable time (at least 30 minutes minimum) within the same controlled area. In the same way, on return and crossed routes, the last letter of the bigram will be most unlikely to be found at the same time. In a given time, no other flight can have the same bigram within the same controlled area.

Within the airline, opposite bigrams are not to be found, and there is little probability for the last letter of the bigram to be used both at the same place and at the same time. This bigram of identification cannot be confused with a reference point to two letters.

Discussion....

One of the problems we often meet as pilots is that, upon crossing the border, a different system applies. According to Captain Vermeulen one only finds solutions to a particular problem in a particular area. Bigram for example is based on full automation. For application throughout the world, it has to be realized that it will take at least 20 years before everyone can apply automated systems. We must find a global solution.

Although new call signs may find implementation, Mr. Domogala queried why airlines continue with their present call sign allocation systems. In this respect Captain Vermeulen expressed his view that airlines do not understand what pronunciation problems we have. As the people, assigned to allocate call signs, often have no pilot- or controller experience, you get the impression that you are talking against a brick wall.

Incident without Accident - A Case Study

by Mr Ehrhard Hochstein *(Eurocontrol)*

Introduction.

The following will give you some detailed information of an incident that occurred in the Maastricht airspace more than a year ago. The occurrence was originally reported as a typical example of call sign confusion, but after investigation it transpired that non-appliance of standard R/T phraseology was a main contributory cause of this incident. Fortunately this did not result in an infringement of separation standards or an accident.

The situation.

Two aircraft, a Gulfstream followed by a Boeing 737, were about to enter the Brussels UIR via the UG1. The G2 was coordinated at FL370, whereas the B737 was coordinated climbing to FL290 and requesting FL330. The distance of 15 NM at the time of transfer of communication was increasing as the G2 was faster. Initial contact was established with the following transmissions:

"Maastricht control, good afternoon, Alfa Four Oscar Alfa Alfa ... at three seven zero".

"Roger sir, we have radar contact, three seven zero, Koksy Sprimont Nattenheim and you have an awful whistle when you are transmitting".

"Koksy Sprimont Nattenheim, was that cleared three seven zero".

"Yeah, or do you like higher".

"... that will do".

"Okay, three seven zero to maintain".

This conversation sounds like a normal first contact with the aircraft. The controller had no doubts that R/T contact was established with the G2 and that this conversation was unambiguous. What he did not know, or did not realize, is that the second and third response of the airborne station originated from another aircraft than the one identified after the first call. The other aircraft was an airliner with a call sign similar only in one respect: an "Alfa" at the end of the call sign.

What happened?

Both flights were sent to Maastricht frequency at about the same time and made their initial call simultaneously. Both transmissions lasted an equal period of time. The response to the initial call was picked up by the B737, who also had called Maastricht but couldn't know that his call sign was not heard on the Maastricht frequency ... The B737 complied with the clearance and continued its climb to FL370.

The G2 pilot realized that Maastricht already was in contact with another aircraft and consequently repeated his initial call when this conversation was finished. The controller was only aware that confusion existed when he received this second call and noticed that the mode C read out of the B737 indicated a climb beyond FL290. Before a dangerous situation could arise the controller was able to rectify the situation.

How could this occur?

Different things have contributed to this occurrence. After they had listened to the tape recording, some experienced controllers concluded that the squeal was most probably brought about by simultaneous transmissions. But the sector controller did not have such an experience yet; he was not warned.

Summarized in his own words the opinion of the B737 pilot was given in his report to the ground station after the incident:

* you acknowledged my call and cleared me to FL370,
* I read back the clearance
* and you agreed with it.

Was the pilot not surprised to get a clearance for FL370? Not at all! The pilot's report stated: "we were changed to Maastricht with the phrase: for higher level call Maastricht. Immediately prior to the frequency change we had discussed the option of climbing to FL370 and therefore, when we were offered FL370, we did not think that unusual".

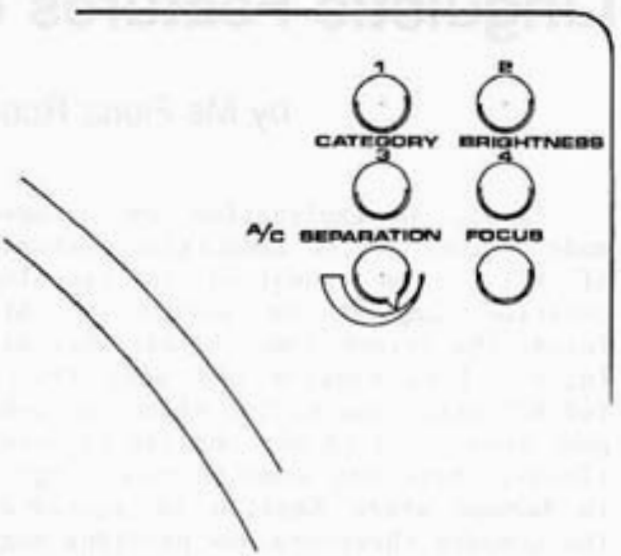
How could this misunderstanding have been avoided?

Obviously one cannot prevent simultaneous transmissions of two stations in the future. To my knowledge no technical device exists at the moment that warns either the pilot or the controller of such a rare occurrence.

Annex 10, Volume 2, chapter 5, para. 5.2.1.6.3.3.3 states:

> "In order to avoid any possible confusion, when issuing ATC clearances and reading back such clearances, controllers and pilots shall always add the call sign of the aircraft to which the clearance applies".

Both ground and airborne station did not comply with this rule. If the controller would have used the call sign when he responded to the initial call, no confusion would have occurred. On the other hand, when the pilot would have used the call sign in his acknowledgement, it would have been apparent that a different aircraft was answering to the clearance.



After such an incident it is always interesting to learn the views of pilots and controllers. On many occasions it is difficult to remember which phraseology was used. The pilot reported:

"Throughout this exchange the first officer used correct R/T phraseology and included the call sign on each transmission".

Unfortunately this did not correspond to reality.

With respect to routes it is worthwile to mention that both flights had an identical route through the Brussels UIR. So the route clearance could not contribute to an early detection of the misunderstanding.

Only the use of standard R/T phraseology would have clarified the situation at an earlier stage, i.e.:

* include the call sign in each transmission and
* do not use abbreviated phraseology when issuing or reading back clearances, e.g. "maintain FL370" by the ground station and "continuing climb to FL370" or "leaving FL290 for FL370" by the airborne station.

Summary.

Confusion could have been avoided by using the R/T call sign in the issuance and readback of a clearance or by using non-abbreviated phraseology. The application of correct R/T phraseology and R/T discipline continues to be an area of concern which merits improvement. Pilots and controllers must refrain from ambiguous transmissions, which are subject to interpretation and could finally lead to confusion and possibly dangerous situations.

Discussion....

It was proposed to send always one aircraft at a time to the other frequency, which is, as Mr. Ralston mentioned, a standard procedure, but unfortunately not adhered to. In Mr. Plukkel's opinion the first answer is the application of R/T discipline. Further to that it was suggested to add the company prefix to the call sign if equal numbers are involved (e.g. KL665KL) and thirdly it should be a habit to inform the pilots in case of possible confusion .

Mr. Kessels explained that it was common practice in The Netherlands, primarily because of flight safety reasons, to visit each military unit regularly with a radio listening out car. In this way sloppy R/T is brought to the light immediately. Proficiency/ competence checking takes place in the United Kingdom at least once a year; ordering retraining does occur!

Linguistic Features of English R/T

by Ms Fiona Robertson *(Université de Franche Comte, Besançon)*

First, an explanation why I have made a study of the linguistic features of R/T. I am involved in teaching aviation English to pilots in Air Inter, the French domestic airline. Air Inter pilots usually use only French for R/T over France, but since the company forms part of Air Charter International, there are some charter flights in Europe where English is required. The company therefore now provides English courses to brush up on R/T English.

Before I could devise teaching materials for these courses, I had to define the linguistic content of R/T. What is it? It certainly isn't ordinary conversational language, or at least, not normally. With a certain amount of perseverance, I managed to track down the official texts: ICAO, Annex 10 and CAA, CAP413 and latterly, since January

1985, the French DGAC legal text. While these texts are very interesting, they are not really helpful for the teacher and serve as works of reference rather than working documents. Nobody can learn the phraseology from these texts, nor were they designed for this purpose. A couple of paragraphs from DGAC will illustrate this (figure 1).

These disjointed lists of alternatives have to be developed into mini-dialogues for start-up and push-back to make them into meaningful exchanges to be practised in the classroom. The last line of para. 11.5.4.d - "Expect (number) minutes dealy(reason)" - shows how many gaps there can be in the phraseology. What are the possible reasons? As a language teacher, I need to know what kind of vocabulary these unstated "reasons" encompass, and then ensure that my pupils know the necessary words.

After I had perused these somewhat disjointed statements of phraseology as

Figure 1.

11.5.3. Mise en route

*a) (emplacement de l'aéronef) DEMANDE MISE EN ROUTE	(aircraft location) REQUEST START UP
*b) (emplacement de l'aéronef) DEMANDE MISE EN ROUTE, INFORMATION (identification ATIS)	(aircraft location) REQUEST START UP, INFORMATION (ATIS identification)
c) MISE EN ROUTE APPROUVÉE	START UP APPROVED
d) MISE EN ROUTE À (heure)	START UP AT (time)
e) PRÉVOYEZ MISE EN ROUTE À (heure)	EXPECT START UP AT (time)
f) MISE EN ROUTE À VOTRE CONVENANCE	START UP AT OWN DISCRETION
g) PRÉVOYEZ DÉPART À (heure) MISE EN ROUTE À VOTRE CONVENANCE	EXPECT DEPARTURE AT (time) START UP AT OWN DISCRETION
h) CRÉNEAU À (point significatif) ENTRE (heure) ET (heure) MISE EN ROUTE EN FONTION	SLOT TIME AT (significant point) BETWEEN (time) AND (time) START UP ACCORDINGLY

Exemples :

1) - Foxtrot bravo victor golf écho, delta huit, demande mise en route, information lima.

2) - Speedbird three zero five, expect departure at two four, start up at own discretion.

11.5.4. Repoussage

*a) [emplacement de l'aéronef] DEMANDE REPOUSSAGE	|aircraft location| REQUEST PUSH BACK
b) REPOUSSAGE APPROUVÉ	PUSH BACK APPROVED
c) REPOUSSAGE À VOTRE CONVENANCE	PUSH BACK AT OWN DISCRETION
d) PRÉVOYEZ (nombre) MINUTES DE DÉLAI (raison)	EXPECT (number) MINUTES DELAY (reason)

* L'astérisque indique une communication du pilote.

it ought to be, I turned to live recordings of phraseology as it actually is. Since I was interested in studying the pilot's needs in English R/T, I edited tapes recorded in the cockpit during a flight, cutting out all other traffic, thus leaving the dialogue between one pilot and a series of controllers. Below is a transcript of the beginning of such a tape recorded during a flight from Palma to Orly.

PIL : SF 8061 Good afternoon.
CTL : Can you say again your call sign.
PIL : SF 8061. To Paris Orly expect departure at 17.10. Is there any delay to expect?
CTL : No delay expected at the moment sir, call 5 minutes before start.
PIL : Thank you I'll call you back 5 minutes before.

PIL : SF 8061 Good afternoon 5 minutes before start-up.
CTL : SF Good afternoon and stand-by will advise to start. May you confirm your full call sign.
PIL : SF 8061 To Paris Orly.
CTL : 8061 Stand-by will advise.

CTL : OK 8061 expect take-off time at 16.03 cleared to start up at your discretion.
PIL : SF 8061 I expect departure at 16.03 correct?
CTL : That is correct sir, clear to start-up at your discretion.
PIL : Roger SF.

Once a certain number of transcripts of this type were made, it was then possible to make some sort of systematic analysis of the type of language used. One way to approach an analysis of this kind is to ask what makes this type of dialogue different from ordinary conversation or, to take a more analogous situation, from an everyday telephone conversation. Some of the distinctive features of R/T are:

1) Elision. A lot of words are dropped out, thus giving a telegrammatic kind of communication e.g.
Controller - ... climb (to) (flight)(level) 310.
Pilot - (We are)(climbing) (to)(flight)(level) 310.
In this exchange, every item in brackets may be left out.
2) Predictability. The high degree of elision is only possible because of the high degree of predictability. When a friend calls on the telephone it may be for any one of a large number of reasons, whereas when a controller calls a pilot or vice versa the reason is highly predictable. In other words the person listening very probably knows what the speaker is going to say. This predictability helps counteract noise and other interference during bad reception.
3) Restricted language. The vocabulary and grammatical structures used in routine R/T exchanges are very limited.

To help me know what should be included in teaching material for a basic language course in R/T, I decided to investigate item 3) above. I made a

Highest Frequency words

Figure 2.

roger	88
(flight) level	86

Greetings

good afternoon	35	70	good day	23	
good morning	35		goodbye	16	

Verbs

clear		43	leave	5	17	cross	8	9
cleared		39	leaving	12		crossing	1	
contact		31	reach	2	16	proceed	6	10
continue		16	reaching	12		proceeding	4	
estimating		15	turn	17	22	start	6	9
climb	13	21	turning	5		starting	3	
climbing	8		squawk	18	19	approaching		8
descend	11	19	squawking	1		change		8
descending	8		reduce	5	8	confirm		7
go (ahead)		18	reducing	3		land		8
maintain	20	31	call	7	8	passing		8
maintaining	11		calling	1		passed		1
report		16						

Other Words

affirmative	14	heading	20
correct	13	runway	31
clearance	12	feet	26
left	19	knots	19
right	10	take-off	12
now	20	wind	13
over	28		

word frequency count on 45 minutes of taped flights edited in the same way as the Palma/Orly flight illustrated above (figure 2). The numbers give the number of occurrences of that word in 45 minutes of continuous exchange. The pairs of verbs reflect the"instruction-readback" type of dialogue e.g. "climb

'... - climbing ...". It is interesting to note that pilots seem to avoid saying "squawking".

These investigations led me to other studies in the same area. Of these, one of the most interesting is that carried out by Mr. Pierre Falzon who took 20 hours of live recording in a control room in France. These recordings are in 4 parts of 5 hours each,

Vocabulaire Anglais

Figure 3.

N°	VOCABULAIRE	Eff	Occ	Ban	Freq	Frecum	Lexcum
1	level	320	135	19	7.15	7.15	.40
2	squawk	242	21	19	5.40	12.55	.81
3	contact	226	22	19	5.05	17.60	1.21
4	flight	186	71	14	4.15	21.75	1.62
5	bonjour	180	3	19	4.02	25.77	2.02
6	to	177	108	19	3.95	29.72	2.43
7	maintain	174	26	18	3.89	33.61	2.83
8	roger	137	1	16	3.06	36.67	3.24
9	goodbye	134	2	14	2.99	39.66	3.64
10	on	131	47	17	2.93	42.59	4.05
11	you	130	93	18	2.90	45.49	4.45
12	recleared	102	36	17	2.28	47.77	4.86
13	down	92	27	18	2.05	49.82	5.26
14	and	84	11	15	1.88	51.70	5.67
15	call	79	38	14	1.76	53.46	6.07
16	up	76	26	13	1.70	55.16	6.48
17	cleared	73	22	13	1.63	56.79	6.88
18	proceed	66	28	18	1.47	58.26	7.29
19	back	62	28	14	1.38	59.65	7.69
20	now	56	33	12	1.25	60.90	8.10
21	your	55	43	14	1.20	62.13	8.50
22	i	55	24	13	1.23	63.35	8.91
23	aurevoir	50	1	10	1.12	64.47	9.31
24	heading	48	32	10	1.07	65.54	9.72
25	for	47	37	12	1.05	66.59	10.12
26	confirm	44	41	11	.98	67.57	10.53
27	goodday	43	2	10	.96	68.54	10.93
28	the	38	34	14	.85	69.38	11.34
29	affirmative	35	3	14	.78	70.17	11.74
30	sir	35	4	14	.78	70.95	12.15
31	at	34	23	11	.76	71.71	12.55
32	report	34	16	12	.76	72.47	12.96
33	descent	32	23	12	.71	73.18	13.36
34	is	30	21	11	.67	73.85	13.77
35	descend	29	15	15	.65	74.50	14.17
36	turn	29	18	10	.65	75.15	14.57
37	speed	27	15	8	.60	75.75	14.98
38	calling	26	8	11	.58	76.33	15.38
39	approach	26	5	7	.58	76.91	15.79
40	course	25	13	8	.56	77.47	16.19
41	initially	23	19	10	.51	77.98	16.60
42	say	20	10	11	.45	78.43	17.00
43	routing	19	14	10	.42	78.85	17.41
44	next	19	15	8	.42	79.28	17.81
45	frequency	19	16	8	.42	79.70	18.22
46	radar	19	6	9	.42	80.13	18.62
47	standard	17	12	9	.38	80.50	19.03
48	in	17	15	7	.38	80.88	19.43
49	indicated	17	8	6	.38	81.26	19.84
50	direct	16	12	9	.36	81.62	20.24

during busy and quiet periods, from upper airspace and in a terminal sector. A computer analysis was then made of the English and the French used by the controllers. The total number of items of English vocabulary are 247, while French is 467. If we consider that the average educated native speaker of English uses between 2,000 and 3,000 items of vocabulary, we can see that R/T is indeed a restricted form of language. Figure 3 gives the first 50 most frequent items in the Falzon study.

Turning to the grammatical structures used, I returned to my transcripts of 45 minutes of pilot/controller dialogues and collected data on the verb structures. In the table in figure 4 the list of occurrence of the various tenses and verb forms are compared with those of another study done by Dodgson on tapes taken at Leeds airport. A comparison gives some idea of the differences between native and foreign speakers of English. The figures here reflect the dominance of the "instruction - readback" exchange, relieved from time to time by the odd polite phrase or two.

Another way to analyse a piece of written or spoken discourse is to identify the different language functions involved and study the ways of expressing each function. In R/T, a language function could be "initial contact" or "taxi instructions" or "instructions to change level". In the Falzon study, there are 247 different instances in English of "instructions to change

Figure 4. **SYNTAX DATA IN TERMS COMPARABLE TO DODGSON'S**

In 45 minutes of tape

Tapes presented here :			Dodgson
Imperatives	145		34
Past tense	2	3	14
was/were + Ving	-		
Present Perfect	1		
Present Simple	19	110	48
(is/are) + V + ing	91		
I'm	-		1
was	-		1
have + to + verb	3		1
had + better	-		1
can	1		3
could	-		2
should	-		2
may	1		2
would, 'd	3		6
will, 'll	9		15
shall	1		

level" and of the 247, 104 are different messages. The first 50 are listed in figure 5.

On the basis of what has been said so far, it would seem that the language teacher has a relatively easy task - teach 250 odd words and some very basic bits of verb tenses and we'll have it all wrapped up. Well, for routine communications that would seem to be correct, but let's consider the following extracts (selection of incidents taken from "PILOT CONTROLLER ENGLISH" series):

Gestion du trafic aérien :

INSTRUCTIONS DE CHANGEMENT DE NIVEAU

N°	Eff	Ban	Message
1	19	4	cleared up flight level PFL
2	18	5	recleared down level PFL
3	16	6	cleared down flight level PFL
4	13	6	recleared down flight level PFL
5	10	6	recleared up flight level PFL
6	9	4	recleared up level PFL
7	7	1	descend at level PFL
8	7	1	recleared down to flight level PFL
9	6	5	cleared down level PFL
10	6	4	recleared down PFL
11	6	2	climb flight level PFL
12	5	4	descend flight level PFL
13	5	2	recleared up PFL
14	4	3	descend level PFL
15	4	3	cleared up level PFL
16	3	2	cleared down PFL
17	3	3	recleared level PFL
18	3	3	down to PFL
19	3	2	cleared up flight level PFL initially
20	3	1	up to flight level PFL
21	3	1	up flight level PFL
22	3	1	continue descent flight level PFL
23	2	2	recleared up flight level PFL now
24	2	2	cleared flight level PFL
25	2	1	recleared at level PFL
26	2	1	up to PFL initially
27	2	1	recleared flight level PFL
28	2	1	climb flight level PFL initially
29	2	2	cleared level PFL
30	2	1	down to flight level PFL
31	2	2	descend to the flight level PFL
32	1	1	down PFL
33	1	1	at level PFL
34	1	1	you are recleared up PFL
35	1	1	start descent level PFL
36	1	1	you are recleared down level PFL
37	1	1	descend to be level PFL level over BAL
38	1	1	you are cleared down level PFL
39	1	1	you are recleared up level PFL
40	1	1	cleared down PFL initially
41	1	1	descend PFL
42	1	1	you are recleared on level PFL
43	1	1	recleared down flight level PFL anytime
44	1	1	descend now level PFL
45	1	1	climb level PFL
46	1	1	climb PFL
47	1	1	leave now PFL
48	1	1	up PFL initially
49	1	1	you descend level PFL
50	1	1	recleared up level PFL final level

Figure 5.

PIL : Ground / there appear(s) to be 2 men and a wheelbarrow the taxiway ahead of us.
CTL : Roger / they should give way to you / if not perhaps you could flash your landing lights.
PIL : We've done that, but they haven't moved.
CTL : Roger / hold position / I'll get a control van out to them.

CTL : Expect start-up in about an hour.
PIL : Couldn't we start-up earlier because we have race-horses on board and they'll be dead by then!
CTL : I'll see what we can do but it's a bit of a rush at the moment.

The normal characteristics of R/T have disappeared here and all sorts of things that don't figure on the carefully compiled vocabulary and structure lists have crept in: "wheelbarrow" or even "race-horses" cannot be very high on anyone's frequency list of vocabulary and the grammatical subtleties of "they should ... if not perhaps you could ..." or "couldn't we ... because ... and they'll ..." come quite late in the syllabus of the foreign language learner.

The point to be made here is that such non-standard dialogue occurs not due to lack of discipline, or human beings desire to express their personalities on the airwaves, but because there is no provision in the phraseology for the unpredictable. In a non-routine situation, when the pilot and controller are probably pre-occupied with other things, the R/T phraseology offers no help and they are thrown back onto their own linguistic resources. The official texts deals with the strictly routine, including, of course, a routine for emergencies, and that is all. I feel sure it would be possible with a bit of intelligent thought and application to find a concise and efficient way to fill this gap.

In conclusion, I would like to see a more effective standardisation of the official phraseology. The recent ICAO recommendations have given rise to at least two slightly differing interpretations, one from the CAA, the other from the DGAC (France). I would also like to see more consciousness raising about the folly of poor R/T English and greater priority given to English both at initial training and during in-service training.

Finally, I hope we might have phraseologies presented in a more complete way giving both sides of the dialogue, with a system of language able to cope with the unpredictable like wheelbarrows on runways and horses likely to expire if the controller isn't cooperative.

Modern Audio Communications Equipment

by Mr Reinhard Bolnberger *(AKG Acoustics)*

For the reason that most of you will not know very much about AKG, I will give you a short introduction.

AKG stands, in English, for Acoustic and Cinema Equipment. The company was founded more than 35 years ago in Vienna, the place of music. This is the background of the manufacturing programme. Basically we manufacture acoustic components which are placed into microphones and we have invented the first carduit microphone, which ensures that microphones can pick-up under noisy environments "His Master's Voice"!

Here in Vienna we employ 700 people developing all our products, manufacturing them ourselves and distributing them all over the world. We have a department for studio microphones where we produce and develop condensor microphones with very sophisticated acoustics. We also have a department for Hifi equipment. You know the Hifi headphones and pick-up cartridges for turntables. We have also been producing, for some years, capsules which should replace carbon capsules used in communication equipment.

Research, however, has not stopped at AKG and in many cases we were the first on the market with a new design. In the meantime we have patented almost 1500 inventions. So, it was only a question of time before AKG would take part in the aviation market, with products for audio communications. In this department we developed microphones, headphones and headsets to be used in R/T communications systems, telecommunications, public address and sound reinforcement.

Our own investigations resulted in many complaints heard before. Heavy headsets, warm ears, poor intensity. We have also found out a further interesting fact, that some of these complaints are based on the Air/Band VHF system, this is amplitude modulation and for example I can say that in 1940 Radio broadcasts had the quality level of today's R/T communication. I guess that this is too poor an indication of microprocessors, compact disc and state of the art infidelity. So I feel sorry that today, there is no representative of the radio industry to discuss all these problems.

Here you can see a discussion schedule for a preferred application area. In the horizontal scale you can see the ambiant noise in dB. In the past we heard typewriter noise from approximately 50 dB up to the threshold of pain, 130 dB. In the vertical scale you see a scale of severity of climate conditions. This allows you to define a product exactly for the purpose you need. Often I have seen oversized headsets utilized in cabins of the newest generation where the noise level is very low. We wanted to improve the intensity and there we have to fight on two sides. One is to have the right microphone and the other is to have the right earphone to correctly understand the incoming messages. The microphone you need should have "close talk" characteristics, it should have "noise cancelling correctors". I can demonstrate to you right now what "close talk characteristic" means. If I speak at this distance you can hear a typical sound. If I speak here, very closely, it is not only more audible but you will hear a deeper sound and the deeper sound of a man at approximately 300/500 Hz is not improving the intensity. But, there is another aspect, the masking of "pop"noise. If I pronounce the word 'population' or I speak 'population' you hear the P is masking the first vocals and this reduced the intensity dramatically. That is not the least of the requirements for a microphone. It has to be less sensitive, it should be comfortable also, less sensitive on VHF frequencies and to body noise. So, this results in microphones which are placed in front of the mouth, they are placed more or less in the corner of the mouth - this reduces the 'pop' noise. The noise cancelling characteristic is done by complicated developments and very tiny and small things in the capsule itself. But, we also have to improve the other end, the headphone. Normally we offer in our headphones a frequency range from 20 Hz up to 18,000 Hz or 20,000 Hz, the full range which we can hear. The ear modulation is at a range of 8 KHz to 9 KHz and you have a very high distortion, jamming and scrambling, this has to be cut-off. So, we reduce our wide frequency range to a typical one that allows the listener to listen for a longer time without stress.

In the past, if one listened in a noisy environment one would become

stressed within a short time. Now you will get the information understanding it better in an improved acoustic situation. If the environmental noise is approximately 60 dB, and you hear a message of 60 dB you will hardly understand it. The ideal difference between signal and "noise" is at minimum 15 dB, best would be 20 dB. If you are working in a cockpit and the noise there is 90 dB you should have a signal measure of 110 dB to understand all the words in the message. But, this is too loud. You have to reduce the ambiant noise in the ear and therefore you should wear earcups. Earcups have to reduce by 25 - 30 dB the ambiant noise and then you can shoot in a signal of 80/85 dB then you

have this difference between signal and noise. Earcups which reduce this ambiant noise so much are inconvenient because they must be of heavy material close to the ear. You will feel warm and sweaty within a short time. So, we recommend you understand exactly where you are working in order that you take only the product which is suitable for your working conditions and not more. What can also be done to improve intensity is to offer an amplifier for the microphone with squelch electronics. This is a voice controlled electronic system which, when you stop sending messages through the microphone, the amplification is drawn down immediately to within 1 microsec. When you start to speak, the amplifier turns up to a certain level and holds it there while you speak. So, in the air and on the ground you will not have the background noise during your transmissions. It is also possible to use an amplifier for the ear capsules which limit the signal to a certain level, thus peaks do not appear and if the volume reduces it stabilises the level which helps you to have a intelligible conversation.

A second target was to improve the wearing comfort. The best way to do this is to reduce the weight. That can be done with high technology and with very durable materials. We are using an automatic headband which enables you to set up the headset without adjusting it. Also, a flexible boom which you can easily adjust the microphone to the right place is very important. The complete headset should enable all parts to be serviceable.

To draw to the end of my lecture I will give you a message that we in the acoustic industry have been using for a long time. With very sophisticated products and acoustics in our equipment I do not think you will hear the difference between the transmitted signal and the original signals in this type of headphone and microphone. I will say that the only way to improve R/T communication dramatically is by greater changes in the Air Band VHF system and in the radio equipment.

Finally, I will give you some information on AKG products. Some of our capsules are completely produced by microprocessor controlled robots. This enables us to give a very high quality level. We have an independent quality department which works with military standards. Some of our capsules have a quality level which NASA approved for the Space Shuttle missions. These capsules you can have right now on ordinary headsets.

For the moment we are working on two microphones and voice recognition so we are preparing for the future.

I thank you for your attention.

Blocked Frequencies and Simultaneous Transmissions -

by Philippe Domogala *(EGATS)*

Now we are going to live one of the nightmares of many controllers. That is the "blocked frequency" nightmare. Why a nightmare? Because a blocked frequency deprives you of the only tool that permits you to address the aircraft: the VOICE communication. All other tools available to a controller - radar, telephone, computer image, flight plans, transponder replies, altitude coding, etc. - are only accessories that enable you to do your job better and more efficiently. But the failure of one of them will not prevent you to work.

If you permit me an audacious comparison: R/T communication is as vital to a controller as the wings of an aeroplane are vital to a pilot. Loss of R/T can be caused by mechanical or technical failure but the vast majority of the cases are caused by the "blocked frequency" effect. I will not expand on the technical or mechanical aspects, I am not a specialist in the matter. But the consequences of a loss of R/T are always a major problem and can lead to a disaster, regardless of the amount of traffic you have.

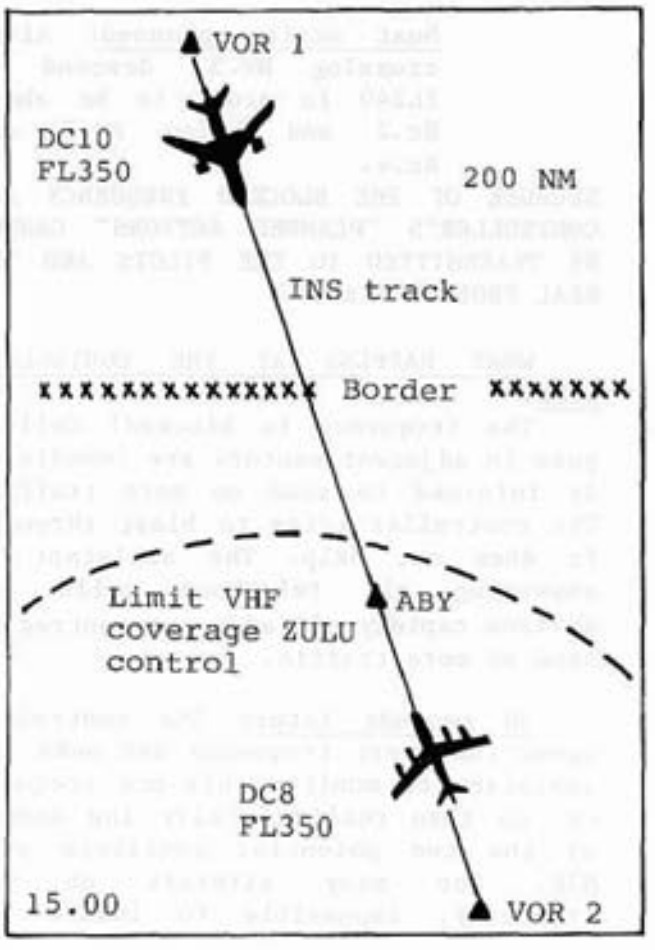
YES, BLOCKED FREQUENCIES DO AFFECT SAFETY !

With 2 aircraft or with 25 aircraft on the frequency. And I will demonstrate

this to you by taking 2 examples that happened, one in Africa in 1981 and the other one here in Maastricht in 1982.

EAST AFRICA, middle of the afternoon. A DC8 and a DC10 on INS tracks, both at FL350, 200 NM apart in two different countries. The DC10 was coordinated at FL350 with, what we will call for example ZULU CONTROL, and transferred 50 NM prior to the border but still outside VHF coverage of ZULU. The DC8, controlled by ZULU, was to be descended to FL330 opposite before ABY due to the DC10.

However, when the ZULU controller was about to instruct the DC8 to descend, he realized that the frequency was blocked and that he could not get through . He tried to contact the DC8 on 121,5 but unfortunately the emergency frequency was unserviceable in this centre. Subsequently the controller tried to phone the airport control tower (25 Km away) in order to ask his colleague to call the DC8 on 121,5. But the TWR controller was busy on HF with a headset and did not hear the telephone. The TWR controller was alone for the afternoon duty, unfortunately not an abnormal situation in Africa.



The result.

The aircraft passed exactly on top of each other still at the same flight level. The GPWS of the DC8 warned and the radio altimeter registered 30 feet.

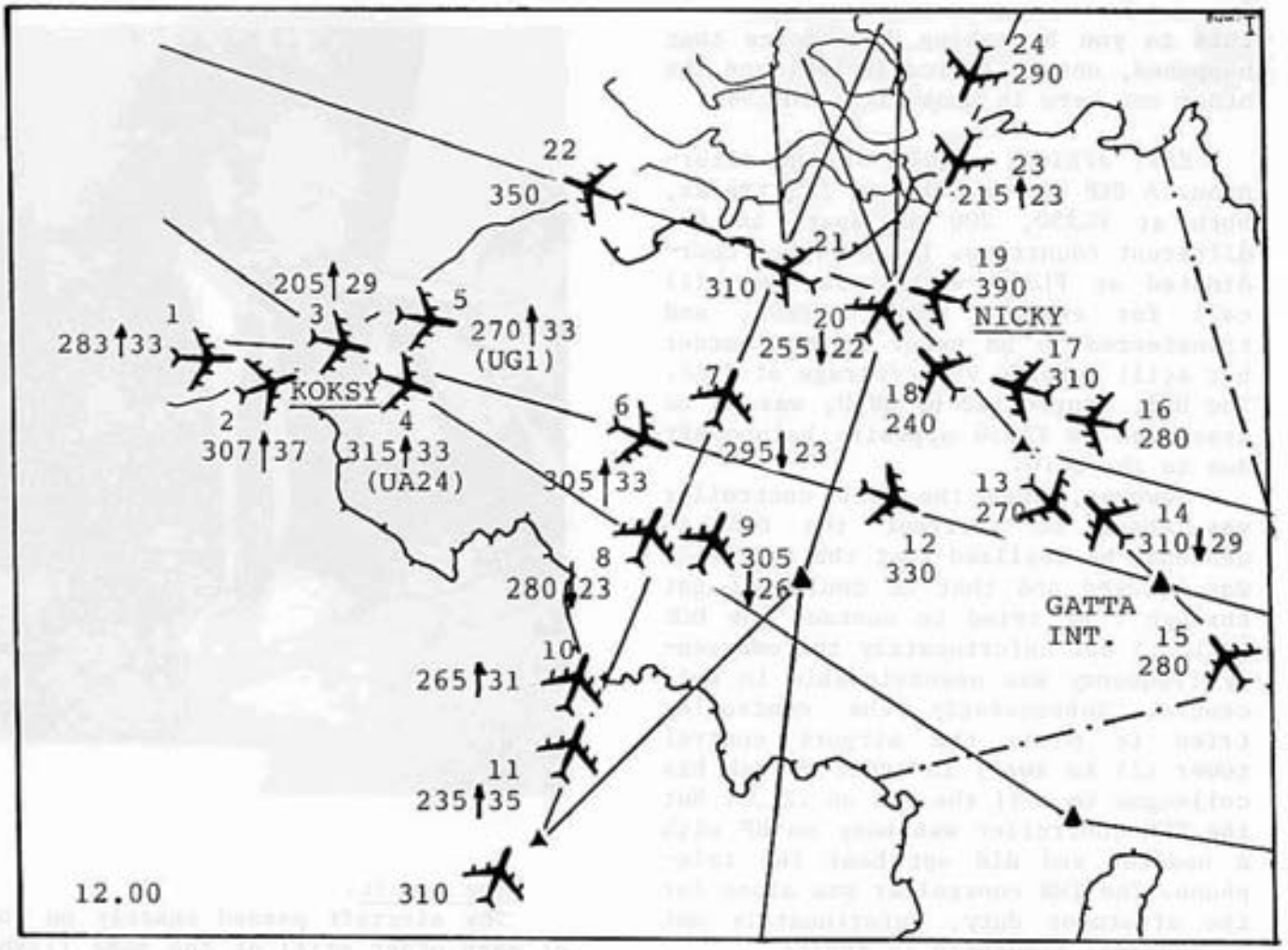
What caused the blocked frequency?

On a previous flight of the DC8 a check pilot had used the observer seat behind the captain and both VHF 1 and 2 were still "ON". During the flight the captain had put his briefcase on the observer seat and due to vibrations the case finally touched the transmit-key and kept it in "transmit" position.

Now we will take a typical MAASTRICHT BRUSSELS WEST SECTOR Summer situation. 23 Aircraft occupy the frequency, which represents medium to high traffic; nothing exceptional for this sector in the summer.
There are four major conflict areas, i.e.

1. the crossing of UG1 and UA5,
2. GATTA intersection,
3. NICKY DVOR,
4. KOKSY DVORTAC.

Of these 23 aircraft, 16 are climbing or descending, which is 70% of the traffic in the sector - also a typical situation - and 4 pairs of aircraft on



a heading, also normal, if not low in proportion to this type of traffic.

Suddenly at 12.00 hours: THE FREQUENCY WAS BLOCKED ! A constant carrier wave, no transmission possible and a loud whistle fills your headset whenever you try to transmit.

We will now devote our attention to six aircraft:

Nr.1: FL270, because of parallel traffic locked on heading.
Next action planned: turn right to regain track and climb when clear of traffic.

Nr.2 and 3: two aircraft inbound to Amsterdam on parallel heading. One descending to FL230, the other one to FL260 with a rate of descent of 1500 ft or more in order to be below Nr. 5 at FL280.

Nr.5: a normal overflight to the United Kingdom at FL280.

Nr.6: a flight from Scandinavia to Paris at FL290.

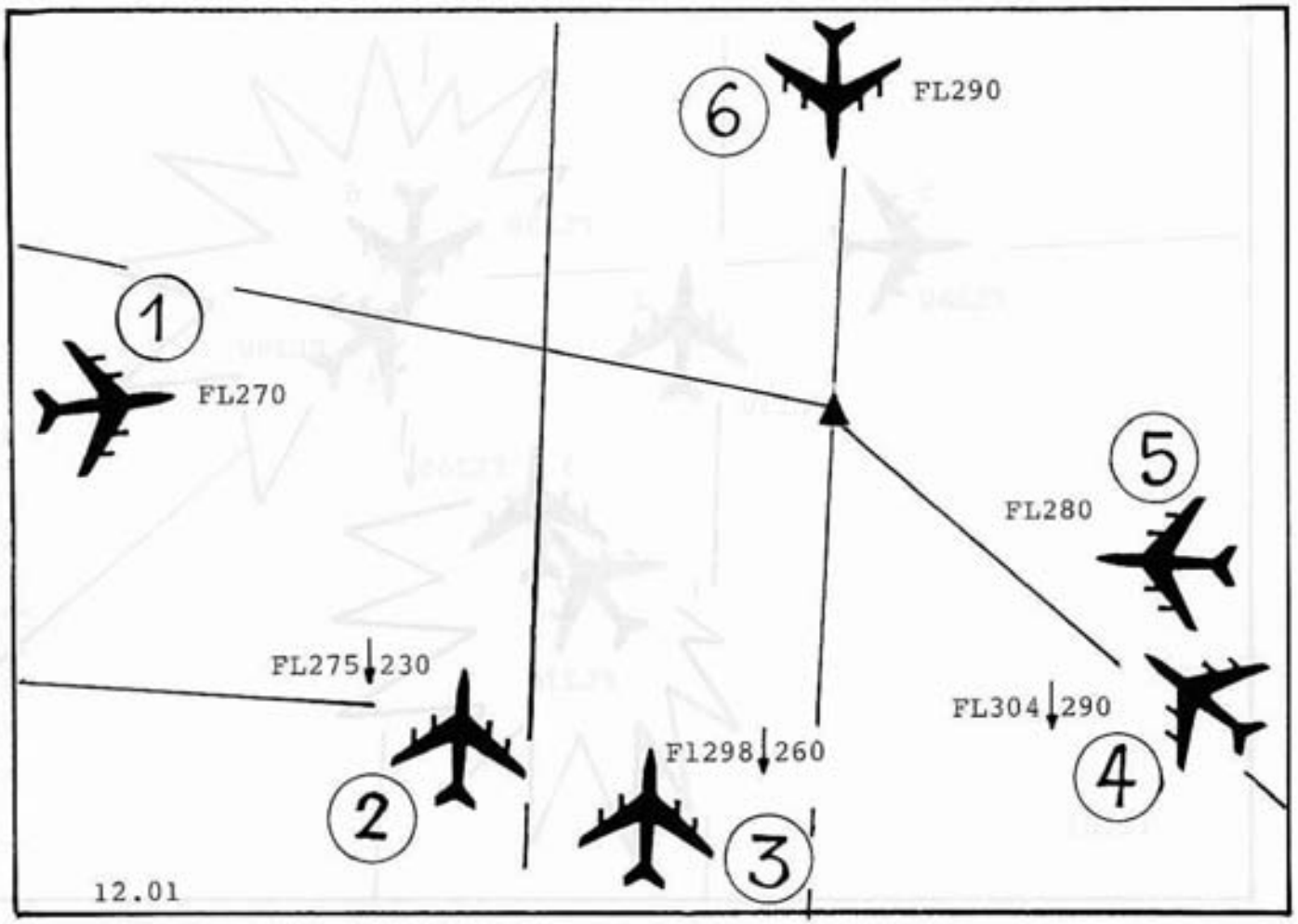
Nr.4: an inbound to Amsterdam, descending initially to FL290 because of Nr. 5 at FL280.
Next action planned: after crossing Nr.5, descend to FL240 in order to be above Nr.2 and below Nr.3 and Nr.6.

BECAUSE OF THE BLOCKED FREQUENCY ALL CONTROLLER'S "PLANNED ACTIONS" CANNOT BE TRANSMITTED TO THE PILOTS AND THE REAL PROBLEM STARTS.

WHAT HAPPENS AT THE CONTROLLER SIDE?

The frequency is blocked! Colleagues in adjacent sectors are immediately informed to send no more traffic. The controller tries to blast through; it does not help. The assistant is answering all telephone calls and advises rapidly all adjacent centres to send no more traffic.

30 seconds later: The controller opens the spare frequency and asks his assistant to monitor this new frequency. He then realizes fully the danger of the two potential conflicts over NIK. Too many aircraft on the frequency, impossible to locate the



culprit. He then tries to call on 121,5. Nobody answers.

An additional 30 seconds have passed: The aircraft are getting closer to NIK. We still cannot warn them of the danger and start praying that the blockage will soon come to an end. The controller tries to break through again and calls Nr.4; he MUST descend! Maybe the Scandinavian flight has the judgement to return to the Amsterdam frequency. Give a call to Amsterdam; tell them to descend the flight immediately to FL280 if it comes.
Time elapses ... the frequency remains blocked ...

WHAT HAPPENS IN THE AIR DURING THAT TIME?

Aircraft nr.1 :
First Officer : what should we do now? Should we maintain this heading, it takes us far from our route ...
Captain : it was quite busy before the break-up, let's continue.

Aircraft nr.2 :
Captain : No problem, we are almost in Amsterdam anyway!

Aircraft nr.3 :
First Officer : I do not think we should keep the heading, our traffic is well in front of us now ...

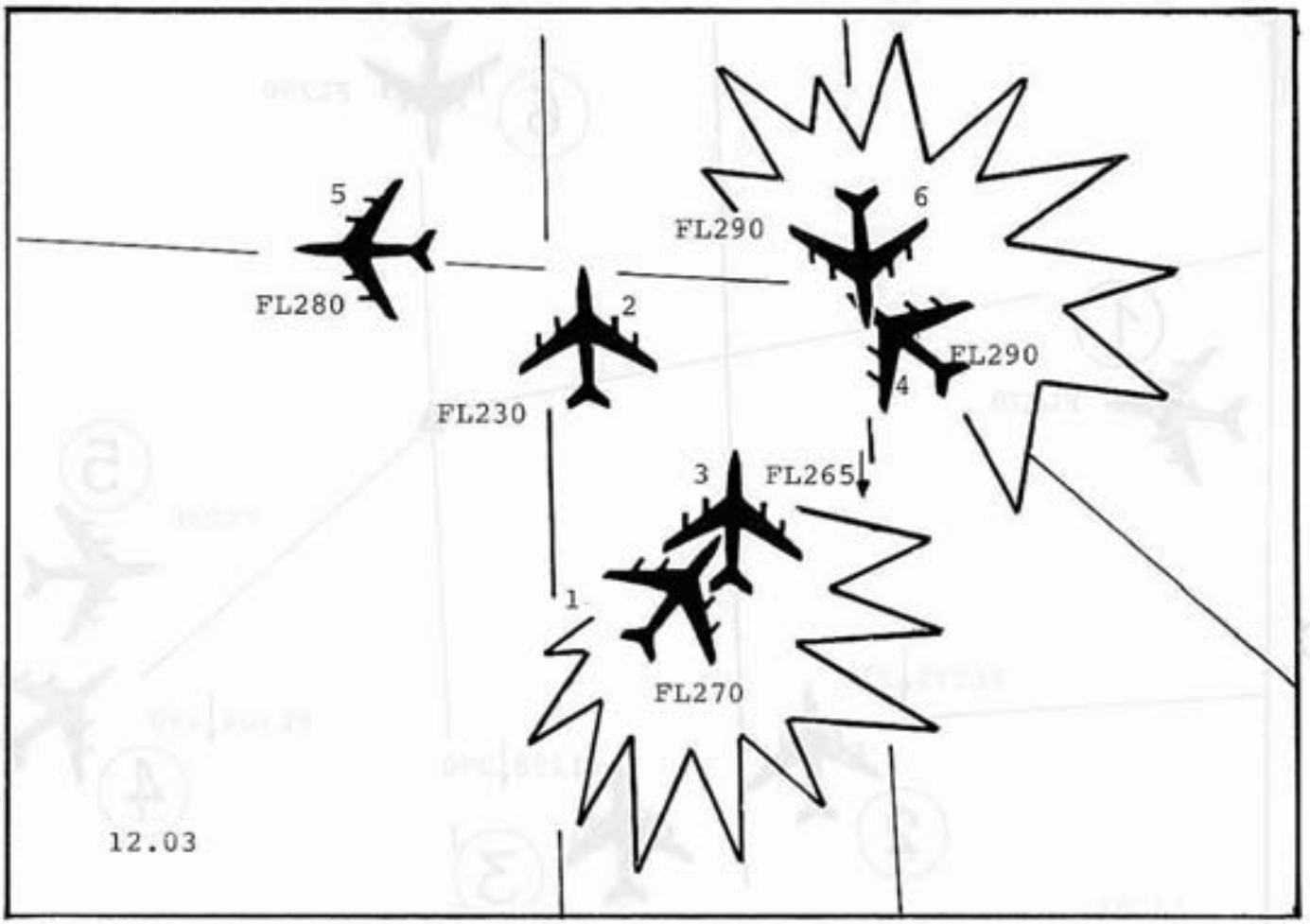
Aircraft nr.4 :
First Officer and captain: (2-men cockpit configuration) studied the approach charts, discussed the procedures and never noticed that the frequency was blocked.

Aircraft nr.5 :
Captain: it does not affect us, we are cruising and only requesting descent in 25 minutes.

Aircraft nr.6 :
First Officer : shall we switch back to Amsterdam frequency?
Captain : No, it's only a blocked frequency, it happens all the time, it will stop shortly ...

AND NOW.

After 3 minutes the situation ends up with two potential mid-air collisions. The controller could do nothing but watch. Aircraft nr. 1 could not be turned back to his route; aircraft



nr. 4 could not be descended after the crossing. After 2 minutes of blocked frequency the situation was still solvable (with an expeditious descent or a turn of 30 or 40 degrees), but after 3 minutes ...

THIS IS WHAT HAPPENED.

In reality the aircraft missed each other by 6 and 4 miles respectively. So there was no real risk of collision. It was PURE LUCK that this minimal separation was maintained. As a controller I do not want this to happen again, but I know it might. As a pilot I cannot accept such a situation. As a passenger, if I knew all this was possible, I would be scared.

So what can we do? The solution is either TECHNICAL (can we prevent frequencies to be blocked?) or PROCEDURAL (can we introduce a special procedure to be applied universally in case of a blocked frequency).
IFATCA was involved, mainly through SC I. Here it was concluded that stuck transmitters lead to DANGEROUS SITUATIONS and require resolution. Captain Ellis will tell you all about a possible technical solution. With respect to procedural solutions IFATCA studied the following options in particular.

1. PILOTS SHOULD MAINTAIN A WATCH ON 121,5.

Pilots are reluctant to apply this procedure. It is argued that the use of 121,5 for this purpose is incorrect: a jammed transmitter is not a true emergency. Besides, 121,5 is not available in all parts of the world.

2. SPECIAL GUARD FREQUENCY.

If 121,5 is neither desirable nor available one could establish a special GUARD frequency on a regional basis. But lack of available frequencies combined with the required standardisation in all ICAO regions seems to be a serious problem.

3. AUTOMATIC REVERSING TO PREVIOUS FREQUENCY.

This also gives a lot of problems: first it cannot be applied on a worldwide basis because of the limited range of the VHF ground transmitters and

possibly some aircraft have not been working a previous frequency. Finally, a sudden increase of R/T load by unplanned additional calls could cause serious problems in a busy sector. Combined with the fact that the controllers will have no jurisdiction in the area from where the aircraft calls, it is most unlikely to apply this procedure.

For all these reasons none of the procedural solutions was considered suitable for recommendation on a world-wide basis. Therefore a technical solution is probably the best one.

The Contran Solution

by Captain Derek Ellis *(Singapore Airlines)*

INTRODUCTION

Thank you, ... for your introduction. I'm reminded, once again, how fortunate I have been to have flown some of the finest aircraft ever built, in fact the type which I am currently associated which could well be the finest, apart perhaps from my Moth.

Before getting into the 'meat' of my paper I believe I ought to clarify my position in this exercise. Nigel Corrigan has come up with what I believe to be, potentially, a very real contribution to flight safety. Like all inventors, although he fights shy of the word, he assumed that the end users of his ideas, in this case the airlines, would beat a path to his door.

He will be the first to tell you that the path to his door is still overgrown. This is where I came in.

After many years of being on the other side of the fence, as far as airline management is concerned. I believe I have something to offer this project, not only in terms of presenting it from the view point of an active pilot, but also looking at the stark realities of "What do the airlines get for their dollar". But we'll get back to that later.

Nigel Corrigan believes that the VHF system is not all that it could be and from what we have heard so far in this Forum he is no doubt correct in this thinking. He's convinced me; in fact he advised me to placard my VHF transmit switch with a small notice, "Caution-correct use of this system could be hazardous to your health".

So far I've fought shy of the notice, but, apart from that, let me tell you why I agree with him.

R/T - THE VITAL LINK

R/T - The vital link. Whilst no-one would argue with designating R/T communications a "vital link", what should be questioned is the frequency with which the "vital link" is interrupted, broken or otherwise interfered with in the course of routine but vital communication, and the extent to which this interference can be considered an irritation on the one hand, and down right dangerous on the other.

I am not referring to interference caused by atmospheric static, that was eliminated with the introduction of modern VHF communications. Neither am I referring to a break-down of communications caused by unreliable equipment. Today's VHF equipment has reached a stage of almost legendary reliability.

I am referring to an interference problem which is growing in intensity. A problem which has been established to be a contributory cause of numerous serious accidents, a cause of countless incidents, an interference which I find these days I encounter at some stage of every flight I make, and which I, as an Airline Pilot, consider to be an outright menace.

I am referring to the growing problem of the disruption of the "vital link" caused by the conflict of Simultaneous Transmissions.

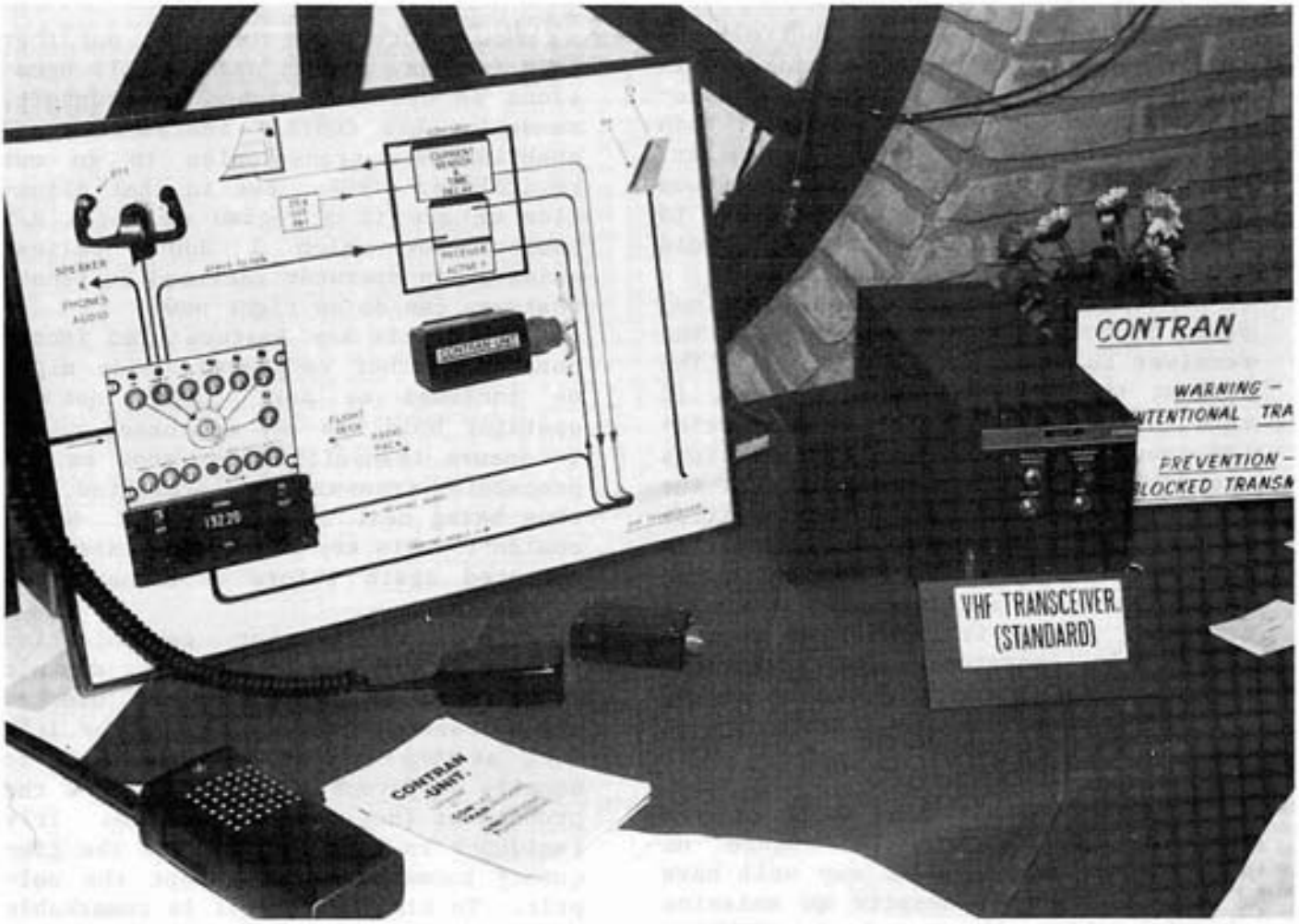
How often do I hear an Air Traffic Controller say to a pilot "Please listen out before you transmit"? If only the problem was so simple to resolve. Such a comment is really a waste of time because pilots do listen out before transmitting and no pilot deliberately transmits into an active frequency. If anyone feels like challenging that statement I would respond by asking what on earth a pilot would expect to gain by such a deliberate transmission. He, of all people, knows only too well that the result of such action will result only in a loud squeal and the necessity for all concerned to restart the communication process all over again. It would be bad enough if that were the only consequence but regrettably such occurrences can, and have led to misunderstood clearances, sometimes with tragic results.

So if everyone, pilots and controllers exercise perfect R/T discipline, how is it that we experience so many conflicting transmissions that the Americans have even started using new, and in their apt way, entirely descriptive terminology. "Say again you were stepped on".

The problem is quite simple to explain. When any pilot or controller commences a transmission he believes the frequency is clear. What he cannot cater for, and up till now no-one has bothered to try to cater for, is that, at the moment someone initiates a transmission, someone else, somewhere else, has the same idea. Both communicators listened out, both were satisfied that the frequency was clear, both transmitted. Result, at the very least, "say again, you were stepped on".

You may well ask if I am now going to recommend that everyone licensed to press a transmitter key should also be required to qualify in telepathy, or extra sensuary perception, or whatever. I might have been inclined to ask a similar question myself had it not been for an event of a couple of years ago, and I will digress for a little history.

Just over three years ago a prominent British Airline made me an offer I could not refuse, and, with some regrets I parted company with the Concorde and went to fly 747s in Singapore. Soon after becoming established there I met a British avionics engineer who had been so moved by the Tenerife accident that he decided to use his undoubted



abilities to help make sure such an accident couldn't happen again. His name is Nigel Corrigan and he just couldn't understand how it was that 580 people could lose their lives from an accident in which one of the major contributory factors was a misunderstanding due to a blocked transmission. How could the problem of blocked transmission be overcome?

The principle of the device which is now available and provides a solution to this problem is quite simple. It assumes that when two highly disciplined operators decide to transmit into an open channel, and simultaneously press their transmit buttons, it is most unlikely that when measured in terms of milliseconds the two transmissions commence at precisely the same instant. They are invariably separated by a time interval too small to notice but which can be determined electronically, and measured in milliseconds.

So came about a device which has become known as the CONTRAN UNIT. It's small, it's light, it's reliable, it's inexpensive and it resolves a known and dangerous aviation problem.

When I first met Corrigan his designs were all on paper. An actual unit didn't exist. It was theory, drawings, paper explanations. It couldn't be seen working because a unit didn't exist. No one was interested in supporting this cranky guy in Singapore, China. I admit to some cynicism myself at that time.

Eventually a prototype was cobbled up. It's full of soldered joints, springs, bellcranks, cog wheels and all sort of junk. But in an avionics workshop in Singapore it was connected to a VHF transmitter and I can claim to be the first airline pilot in the world to use it. Having tried it I resolved that I would certainly not be the only one.

At first we tried the unit using a workshop frequency and simulated other aircraft's transmissions using hand held transceivers. So impressive was this experiment that I did something that might curl you hair. I tuned to the frequency of the local airfield tower, waited until an aircraft called for landing clearance and deliberately pressed my transmitter key. I kept the key pressed beyond the aircraft's transmis-

sion and through the tower controller's reply. Not only did I not conflict with anyone but throughout I heard with absolute clarity the communications of both the aircraft AND the tower controller. No one missed, misheard or misunderstood anything. Yet I held a transmit key to transmit position throughout, and I did have a serviceable transmitter.

What this device does is to continuously monitor the activity of the VHF receiver to which it is attached. The instant the frequency becomes live, it cuts the transmit line of it's associated transmitter. If both transmissions are from transmitters equipped with the unit, the one which becomes active first is the one to transmit, and the later one, measured by an interval which can be as low as 5 milliseconds, does NOT transmit, and as it remains on receive mode, it's operator hears everything that is taking place in spite of keying his 'mic', and can then transmit when the frequency is clear.

Now it's likely that many of you will be jumping at the chance of pointing out that a pilot may well have a need to transmit despite an emission already taking place and the CONTRAN UNIT will make this impossible. For example there may be an open mike on the frequency which an aircraft or controller would wish to try to break through in an attempt to communicate.

To cater for this situation a double key action has been built into the design and the second of two rapid key actions will override the CONTRAN and will allow the operator to transmit.

To clarify the operation of this double key over-ride, as I said, the second of two consecutive key actions will over-ride the CONTRAN. How this is achieved is that every time the press to talk key is released the CONTRAN is made inactive for one half second. So let's assume that a situation arises where a crew, although the channel is busy, feel that a transmission from them may avert a dangerous situation from developing. They key once, release, and immediately key again. If the second key is within the one half second 'window', then they will go to transmit even though the channel is active.

click - click - speak

Now you're going to point out that this facility can be used on all occasions an operator wishes to transmit, rendering his CONTRAN ineffective and enabling his transmission to go out regardless. TRUE. But in that situation we are in a regime of total R/T indiscipline which I don't believe exists. An operator inclined to behave that way can do so right now.

The double key feature also incorporates another safeguard. You might be inclined to ask, "Could not an operator hold his key depressed so as to ensure transmitting as soon as the preceeding transmission terminated, and thus being next in the queue?" No he couldn't. His key must be released and operated again before a transmission takes place.

There is another communication problem which, although it doesn't occur with the frequency of blocked transmissions, when it does occur it's just as big a pest and can lead to equally dangerous situations. It's the problem of the stuck microphone. It's insiduous in that everyone on the frequency knows about it except the culprit. To him the channel is remarkably quiet and peaceful. To everyone else it's useless.

So in tackling the Conflict Transmission problem, Corrigan also addressed the Unintentional Transmission problem. This was also successfully resolved and hence the name CON TRAN UNI T was evolved. CONflict TRANmission, UNIntentional Transmission.

How this aspect of the CONTRAN UNIT operates is that it monitors transmitter operation and, after a predetermined period, say 15 seconds, it brings up an advisory light on the pilot's warning annunciator panel. It does NOT stop or interfere with the transmission
in any way because the prolonged transmission may in fact be deliberate, such as communicating a defect list on company frequency for example, but it alerts the operator that he is transmitting just in case it is NOT deliberate.

The CONTRAN UNIT has been built to a design specification that will ensure a high standard of maintenance free reliability. That is not enough, however, and the system must provide fail safe

capability. If a CONTRAN UNIT should go unserviceable, the associated Transmitter/Receiver will continue to operate in exactly the same mode as a unit not equipped with CONTRAN.

One question which has been put against the viability of the CONTRAN is this. In normal exchanges between an aircraft and ATC a response from one party can be initiated prior to the preceeding party actually releasing his 'key'. If you try that with a CONTRAN you will simply remain on receive. The question is, "Will this not slow down 'snappy' exchanges"? The fact of the matter is that this is exactly what we want to do.

Consider an every day situation with an aircraft expecting a clearance to cross an active runway. It might go something like this ...

"ATC .... Golf Mike is cleared to cross the active, behind the departing DC10".

Golf Mike has heard what he wanted to hear, up to the word active, which he thinks is the end of the message, and keys his mic to respond. He hears nothing about a DC10, but his response coincides nicely with the end of the ATC message. And what does the controller hear when he does release his key .... perhaps only the words "Golf Mike". Another aircraft intervenes and by the time ATC gets back to Golf Mike for a correct read back .... exactly, he's crossing an active runway without a clearance. If the CONTRAN does slow down these 'snappy' responses then I feel that it has achieved its aim.

I shall shortly be inviting questions but it may be useful to wind up by anticipating a number which have been asked previously.

Question 1:

Good R/T discipline should prevent simultaneous transmissions. Why is it necessary to introduce an automatic device to achieve what is already being practised by professional pilots?

Answer 1:

Even perfect R/T discipline cannot prevent conflicting transmissions. Consider two pilots who both wish to transmit, both listen out into a clear channel and decide, quite correctly, to begin a transmission. They may be parked next to one another or flying fifty miles apart. Whose fault is the resulting squeal? No one is to blame since both pilots acted in the best professional manner. No pilot will deliberately transmit on top of existing radio traffic unless he has a very good reason for doing so. He is operating on a discrete frequency and any information on that frequency will, at one level or another, be of interest to him. By creating a conflict transmission he is denying himself that information.

Question 2:

One criticism which has been levelled at the concept involves aircraft at altitude being overridden by reception of distant stations they are not actually using. Will this not create problems?

Answer 2:

Not at all. Simultaneous transmissions only become a safety hazard when aircraft are close to one another, for example when taxiing on departure or landing, or converging on a traffic control area. Received signal strength is high in these situations and the sensitivity of the CONTRAN will recognise these high levels but not the much weaker altitude overlap signals.

Question 3:

To be totally effective it would seem that every aircraft would need to be equipped, yet you have said that any one equipped aircraft gains an advantage over others. Why is this?

Answer 3:

The secondary function, warning of an onboard 'stuck mic', is an obvious advantage to any flight crew. The primary function, that of preventing inadvertant simultaneous transmissions, only operates when the flight crew has, in error, attempted to transmit into a busy frequency. As mentioned previously, the CONTRAN automatically prevents this, and the crew, instead of creating a conflict transmission, can monitor the message, which may contain information vital to their safe operation. The CONTRAN cannot prevent another nonequipped aircraft from coming in after one which is so equipped, but a crew using CONTRAN is assured that, when they began a transmission, the frequency was not in use.

Question 4:

On the technical side, the CONTRAN is designed to be wired into existing

avionics junction boxes to become a permanent part of installation. Will this not introduce commonality problems with existing airline equipment?

Answer 4:

Not at all. The CONTRAN operates by monitoring signals already available within the aircraft wiring, supplied by the standard VHF transceiver. A minor wiring change is required but the ARINC specification, to which the aircraft will have been constructed, is not affected. Once installed, the CONTRAN will operate without any onboard adjustments, or any consideration being given to other equipment compatibility.

Question 5:

Would introduction of yet another unit lower the reliability of the VHF system?

Answer 5:

The circuitry of the CONTRAN is essentially a small part of the most reliable section of standard transceivers, which are currently operating far above 6000 hours before a defect causes removal. There is no reason why the CONTRAN should not exceed this figure several times over.

COST

One obvious question is - how much - and now we come back to the dollars I mentioned earlier. If the trials prove succesful and the CONTRAN goes into production, certified units, with a three year exchange warranty should be available at well under 1,000 dollars. To put that into perspective, an airline operating around 50 aircraft can equip its entire fleet for the cost of one INS nav unit. In fact the CONTRAN UNIT will be cheaper than the VHF antenna it is listening to. For those of you who prefer to use figures related to the cost of fuel, a few minutes fuel burn in a 747 corresponds to the cost of the 3 CONTRANs it will need, and as any equipped aircraft will never suffer delays or go-arounds due to its own 'stuck-mic' or its own simultaneous transmission, who knows, the CONTRAN could well pay for itself the day after installation. But try convincing your accountants of that one!

EXAMPLES OF DOCUMENTED SIMULTANEOUS TRANSMISSIONS

1. Take off on another aircraft's clearance.

The controller called '762 line up runway 12 and hold', followed immediately by '257 line up runway 16 and hold'. He then called '762 cleared for take off wind 110 at 2 knots'. 257 assumed, incorrectly, that the clearance issued to 762 was for him. He acknowledged receipt of the clearance but failed to assure himself that the channel was not occupied by another station. At the time 257 began his read back the frequency was already in use by 762 who was reading back the same clearance. The message from 257 was completely blocked out, only the words 'take off' could be heard on the recorder immediately following the end of 762s transmission.

The controller did not notice the simultaneous transmission because the message from 762 was not distorted or interupted and was clearly audible. He did not realise the significance of the two additional words stuck on the end of 762s read back. Both aircraft began their take off run, 762 on runway 12, and 257 on runway 16. 257 crossed ahead of 762 as they were both climbing out. They don't come much closer than that, and all because of an innocuous simultaneous transmission.

2. Landing without clearance.

A Boeing 737 requested a downwind landing on runway 18. This request coincided with a Tower transmission. His second request unfortunately, also coincided with another Tower transmission containing his landing clearance, which he obviously couldn't hear. He continued with his approach and landing on 18. After touch down he was advised that a second 737 was lined up for take off on 36.

Two incidents which were seconds from becoming disasters, with the potential for perhaps 400 deaths and four aircraft destroyed.

EXAMPLES OF DOCUMENTED 'STUCK-MICS'

For fifteen minutes the crew of an L1011 were cut off from ATC, the reason, a Flight Manual had slipped against the Observers Audio selector panel and was depressing the Transmit switch.

Only ten days previously another Tristar, of the same airline blocked out London Radar communications for several minutes due to a fault in the First Officer's Audio panel causeing any selected VHF to go to permanent transmit.

But it would be hard to beat the British Airways 747 of August the 8th last year, when all three VHFs went to permanent transmit, apparently of their own accord. No fault was found by engineering, but the crew is no doubt wondering when next it will appear.

CONCLUSION

For those of you who may feel that there really is no problem it may be worthwhile to end by quoting the American Air Line Pilots Association, a body of people which is looking very carefully into the whole subject.

In their house magazine for August '84 they said:

"Whatever the solution, one thing is certain: communications interference remains a serious air safety problem that no one in the air transportation industry can afford to ignore. As long as pilots key microphones and talk to the ground, and to each other, the need for vigilance, AND FOR CORRECTIVE TECHNOLOGY, will shadow flight crews and their precious cargoes".

Discussion....

Captain Leonard complemented CONTRAN on the excellent sort of device which seems to fulfill a lot of our requirements. In this view the fitting of mechanical or electronic devices such as these into aircraft should be supported, to overcome what we all recognized as to be quite a serious problem. The incident which was mentioned in his presentation "Aircraft calling" had within it a simultaneous transmission, acknowledging a take-off clearance, whilst the aircraft were lined up at opposite ends of the same runway. Sheer luck held off a disaster!

In reply to Captain Leonard's question when a pilot knows that his transmission is not modulated, Captain Ellis said that he would only transmit when another transmission takes place. So when he presses his key he will hear the other transmission. There is no need for a device that tells us that we are not going out; after all there is no side tone and nothing is heard in the earphones.

Mr. Rahmann asked why this device couldn't be introduced immediately. Introduction can not take place before an evaluation has been made. Until now only one DC9 has a wiring modification installed. The question arises: "Who will accept another evaluation unit?" Mr. Fischer expressed his view that it was very important, in the interest of safety, to evaluate as soon as possible. It was also made clear that ground stations should be equipped as well.

Mr. Green mentioned that frequencies are protected for specific ranges. If a distant call would break through, would it then be impossible to transmit? In reply it was said that simultaneous transmissions are only a safety hazard when the transmitting stations are close to each other. The signal strength of weak distant calls is disregarded by CONTRAN.

During the forum it also appeared that no provision was made for blocked frequencies in the company manuals.

Mr. Gillett concluded the panel session with the statement that the vital, faltering, weak link needs considerable technical improvement. As there are no authorities who see into this vital problem, we have to take our own initiatives to find a solution.

Forum Conclusions

by Rob Bootsma *(EGATS)*

We were together for two days now. The subject was Radio Telephony. We have aimed to provide a dialogue between the user and the industry. We had the possibility to discuss many interesting subjects such as the history and development of R/T, the use of R/T and probable deficiencies, call sign confusion and possible solutions and the linguistic features affecting R/T communication. We were also able to form an idea of medical aspects and the influence of noise, and of possible hardware solutions. Finally a scenario with a blocked frequency and simultaneous transmissions illustrated how quickly we can reach an unsafe situation. A possible solution was shown to us by Captain Ellis.

Although it is impossible to highlight all aspects we dealt with, I will attempt to summarize the wide spectrum that was provived to us. It is useless to say that this represents only an ad-hoc compilation of all material covered in the past hours.

In the aviation world we depend, amongst others, on communication. Pilot and controller must be able to communicate with each other. Without R/T and the aircraft call sign as essential tools we would be unable to perform our tasks. But these tools give rise to a multitude of problems. Both controller and pilot work in an environment almost totally dominated by alpha-numerics (radar vectors, flight levels, speeds, frequencies, and so on). It is not difficult to understand that in this situation errors can occur. R/T quality and extraneous noise contribute to the readability and pronunciation differences may influence the intelligibility of a message. Moreover, the man (or woman) in the air and the one on the ground may execute several actions simultaneously (attention to the frequency may distract from other functions). Particularly in these circumstances we are confronted with what was referred to as "selected hearing". It is quite possible that one hears what one wants to hear.

Is there a solution for this multitude of constraints? The forum started with the proposal to abandon R/T as a main tool of communication. During the course of yesterday afternoon it soon transpired, however, that it would be impossible to do without R/T; it should be retained as the vital link. It was stressed many times that R/T offers the possibility to add something to a message. Captain Vermeulen said clearly: "the pitch of a voice may attract the attention of the person at the other end of the link".

Mr. Field has pointed out that there is a movement towards Mode S, but the question remains: what language should be used when we avail ourselves of a data link? Is there a guarantee that this printed message is interpreted correctly by the pilot? Or in situations requiring immediate follow-up, is there a guarantee that the pilot treats the message immediately? We can reach only one conclusion, despite human factors: KEEP THE VITAL LINK!

The questionnaire revealed that both pilots and controllers have no problems with procedures and phraseology. However, it was commonly understood that we had problems with the application of non-standard phraseology and

procedures. Miss Robertson mentioned already that in certain circumstances one is thrown back to the use of normal language; no standard phraseology exists here. Nevertheless we should use standard phraseology on many other occasions; there is a need for discipline. The used phrases have to be clear, concise and unambiguous.

Still under no circumstances we will be able to give a complete answer! We have to keep in mind that all possible solutions only offer a partial solution. But still, whatever solution we may find, it should be applied worldwide. There is a need for ONE STANDARD FORMALISED LANGUAGE! It would preclude many potential incidents and accidents. At this point I would like to make a remark. Annex 10 does require us to add the call sign to the clearance in order to avoid possible confusion. However, for proper action one has to detect and to be aware of the fact that confusion might occur. But was that the case in the example given this afternoon? After all the call signs differed completely except the "A" at the end of the call sign.

In conclusion it can be said that as long as VHF voice communciation is used as a primary means of communication, confusion and misunderstandings will continue to exist. Nevertheless we should strive for optimization as much as possible. Constant vigilance of both pilots and controllers may contribute to improve air safety.

Written Comments....

Air Traffic Departure Clearances

Captain R.A.C. Goldring.
(Dan Air Services).
25.04.1985.

There is one area of Air Traffic Departure Clearances which causes unnecessary confusion and which I experienced yet again last Sunday at Tel Aviv. I refer to the practice of quoting a specific SID and then qualifying it with clearance to a flight level or altitude different from that contained in the SID. This prompts the crew to query whether the clearance to this different flight level is unrestricted or not. The specific example: "Dan Air 5687 is cleared to Munich via flight plan route, SID six, FL100, squawk 5267".

As SID six gives a block height of FL90 this clearance was queried by the crew with the question: "Confirm unrestricted to FL100"?, to which the answer came: "No, conform with flight level contained in SID". This at best is confusing, wasteful of radiotime and at worst, if unqueried by the crew, highly dangerous.

I would therefore like to see ATC never give a clearance to a level higher than that contained in the SID unless prefixed by the word "unrestricted". Information given in the case quoted above is superfluous, misleading and potentially dangerous.

Blocked Frequency....

When I have a blocked frequency I get an aircraft which is on another frequency and in the vicinity of my sector to broadcast on my blocked frequency, requesting all aircraft to transfer to a standby frequency. This has the advantage of leaving the original frequency blocker on the blocked frequency.

The reason that I follow this procedure is because I have often noted when I had a blocked frequency, that aircraft could break-through and if in the vicinity of my transmitter I was able to broadcast through the frequency blocker. It therefore seemed to me that an aircraft would have a better chance of breaking through a frequency block than a ground transmission. This has proved correct and anytime I have used the above procedure it has always worked.

John Doyle.

The Tenerife Disaster

This unnecessary event was used by several speakers at the R/T Symposium to emphasise their particular presentation. This is my view which has never changed.

The individual primarily responsible, without doubt, was the Airport Director.

The post of director, in any business, embodies one prime duty, above all others, of thinking forward. Planning against events that may never happen or perhaps only once in a life time.

In the case of the Tenerife North airport, the Director must have known what aids he had or did not have. He must have had plans should any of these aids fail but, above all else, he knew that Tenerife had weather that was unique to Europe if not to the world.

Where else do clouds sit on part of the runway giving 100 metres of visibility with the other two-thirds of runway having 10 kilometres or more? Where else can the visibility change from 100 metres to 10 kilometres in a few seconds as the cloud lifts? Where else, before the ILS was installed, did one have an approved procedure of letting down over the sea to below the height of the airfield and then climbing up to land keeping just below the cloud which followed the contour of the land sloping down from the airfield to the coast?

This uniqueness was known to those who operated regularly to this airport and certainly to those who administered the airfield. It would not be known to pilots operating there for the first time. This would apply to the KLM and PA pilots.

Any commonsense forward thinking would have concluded that one day Las Palmas would be closed and all traffic diverted to Tenerife North where apron parking would be insufficient compelling the use of part of the taxy-way. Now add the unique weather!

Directors think forward about these problems, hold meetings and formulate plans. At Tenerife North there would be more reason to do so than at any other airfield I know.

The solution, without ground movement radar, is to instruct the first aircraft to backtrack the runway and call when it has the second aircraft in sight. The second aircraft would also be instructed to call when it had the first aircraft in sight. When both have reported then the first departs. One could also employ a mobile van with a landline to the tower plus green and red aldis lamps.

If the director had initiated such a plan, practiced it every six months, issued appropriate instructions, then the day he had too many aircraft and cloud on the ground his staff would have had an approved plan to work to. It is called duty plus commonsense.

Signed:
an old/not so bold pilot.

Children of the Airways

by Ena Kendall

Charities and appeals sometimes seem so distant from us Controllers, especially in outposts such as Maastricht U.A.C.

However, when you hear of a "Lady" in our own aviation fraternity, supporting an orphanage in Dhaka, between flights!! it becomes a little closer to home.

This "Lady" is one of "us" and I hope that when you have read this article you will join me and support her endeavours.

If you decide to help you will find the address at the end of the article.

Roger Bartlett.

Stewardess Pat Kerr is often ribbed by fellow cabin crew members as the Mother Teresa of British Airways, a tease she accepts good-naturedly if a trifle wearily. Three years ago, she and some colleagues on the twice-weekly British Airways TriStar run to Dhaka, capital of Bangladesh, started to take some of the tedium out of their four-day stopovers by helping at a local orphanage. The bicycle rickshaw men touting for trade outside the city's main hotel can scarcely have known their luck as a lucrative new avenue of business opened up, carrying airline crew and their suit-cases filled with clothes, toys and medicaments on the 10-minute journey to the orphanage. Pat has synthesised the operation from the beginning, putting not only her energies into it but also her heart. To Jahangir, Srithi, Pradip, Dulal, Habib, Rina, Babul, Panna, Lucky and 470 other children crowded into two shabby, flaking Indo-Edwardian colonial buildings on either side of a dusty lane off Indira Road, she has become 'Pat Mummy'.

'Mummy' is a fairly indiscriminate term - in other parts of the sub- continent, 'auntie' tends to be more common - applied by children to whites, including, to their discomfiture, men. But Pat Mummy is clearly someone special. When she arrives, no longer in her British Airways lightweight uniform of a few hours previously but wearing a simple skirt and top in cheap Bangladeshi cotton, she is besieged by children fighting to be noticed, hands waving, clutching, touching, grabbing at her waist, smoothing her blonde hair.

Some would be overwhelmed by the onslaught; she controls it, able to make each child feel the only one in the world, using names, listening intently, joking with them in Bengali. For their sake, she has let her hair grow, because long hair is important in this part of the world, and affects their idea of her. They notice, and get upset, even if she has the ends trimmed. She finds herself searching for lice before tying it up. 'That's not a bad thing to have to do - it keeps you close to their reality'.

Even so, lice do not rank all that high in the reality scale when the competition includes severe malnutrition, diarrhoea in its many forms from shigella to amoebic dysentery, rank-smelling ear complaints, worms, scabies, and a devil dance of cross-infection, made worse by overcrowding: and there is always pressure to take in just one more. As Pat and I talked in the garden - a square of dried-out grass, surrounded by palm, oleander and mango trees - the chokidar (watchman) ran up to ask her to deal with a woman at the gate. The woman, in a shabby sari, was crying bitterly as she begged for her little girl to be taken in. 'If the child's in real need, no matter how crowded we are, we take it,' Pat said. 'There isn't much point in us being here if we don't, is there?'

For starving families the orphanage is the last hope for their children, many of whom are not in fact orphans. Twice in the last 12 months, Bangladesh's rice crop has been lost through flooding and the early-warning signs of famine, cattle being sold and country people moving into the towns, have appeared. Half the 100 million population are landless laboures, 10 million do not even have a roof over their heads and hang on to life by the fingertips.

Before Pat became involved with the orphanage in 1981, the glimpses of street life she had already had away from the westernised cocoon of the hotel had disturbed her. Once, walking in old Dhaka, she saw a young mother suddenly start pounding her baby's head with a stone to make it cry so that Pat would choose her for baksheesh out of the seething competition. This incident affected her deeply. 'I vary between being an agnostic and an atheist and being out here has confirmed my feelings. Some of the people have such rotten lives, especially the women, so if you're only going to live once, you have to help everybody make the best of it'.

She was born in the small Cornish town of Lostwithiel, is an occupational therapist by training and joined British Airways (then BOAC) about 11 years ago. Flying duties normally take her to Dhaka about twice a month and she has spent six months on unpaid leave working at the orphanage, which was opened with 12 children in 1976 by a small Canadian-based charity called Families for Children.

From the start, Pat liked its style. 'There was a feeling anybody could help. Most cabin crew are quite highly qualified in one way or another - teachers, nurses, physiotherapists - and a lot of them agreed to come in to use their experience, to spend their leaves here. One of our engineers helped me build a system of sewers, others have repaired damaged machinery, like our tumble-drier'.

Money to support the orphanage comes from private sponsors in America, Canada and Britain and every single penny goes directly to the children and their care, none to expatriate administrative costs. The children are looked after by 120 or so Bangladeshi staff, who include 100 ayahs, 30 of whom are on duty at any one time, three nurses, nine or ten teachers, a doctor who comes in six days a week and Mr. Dass, office manager and driver of the orphanage's only official transport, a clapped-out 30-year old Vauxhall Victor: during its frequent break-downs sick babies attached to drips have to be rushed to hospital in bicycle rickshaws. Volunteers from the supporting countries come to Bangladesh at their own expense and work at the orphanage for nothing for three to six-month stints.

Jackie Edgar, 22, from Leatherhead, Surrey, a children's nurse trained at Great Ormond Street Hospital in London, who had arrived two weeks previously, had got through her culture shock and homesickness and was laughing off the painful blotched redness of her face and neck caused by mosquito bites. 'The plight of the children completely and utterly shocked me', she said. 'The worst thing is the malnutrition, babies come in absolutely dehydrated. It takes ages for them to recover because they usually have other medical conditions. 'Nine have died since Christmas, including two since this article was written.

About 150 babies and children up to three years occupy one house. Wooden cots are jammed into rooms with peeling walls and bare stone floors. Most of the children are naked, some have shaven heads glistening with the yellow pusfilled blisters of scabies, treated with the scabies lotion brought over by cabin crews. All of them clamour for affection and attention, and the ayahs have to be told to make a fuss of them, especially the children who sit in corners, rocking backwards and forwards, knocking their heads against the wall, a classic symptom of emotional deprivation. Despite their childhood battles against disease and deprivation, they grow into children of remarkable physical beauty and appeal, vital and well-mannered. 'Technically, we're doing everything wrong. They're brought up en masse, not in small groups, but it's a very happy place. They get security, more affection and education than they might have otherwise', Pat said. The first arrivals of the 1970s are now growing up and a new range of problems is looming.

Lakhi, who likes to anglicise her name to Lucky, is 12, and is taking special subjects at the orphanage school so that she can do a nursing aid course when she is 16. Nursing jobs offer residential accommodation so Lakhi has an alternative to marriage, usually the only option for a girl who can't move out on her own. 'Obviously we never push them out', Pat said, 'but if they have any relations, we keep in touch with them. Girls have to have a dowry, that means enough cash to buy some cooking pots and a new sari, and we give them the money'. Two have been married from the orphanage.

So far, Pat believes, airline involvement has made life at the orphanage pleasanter. 'But our biggest piece of help is yet to come'. This is no less than the building of a new orphanage outside the city, a project British Airways is now backing officially after a letter Pat wrote to Lord King, the chairman. The aim is to raise £ 300,000, largely among airline staff, though outside help will be welcome. The appeal is an urgent one because the leases on the present houses run out in two years'time. Pat has already found a site six miles east of the city and has embarked on the Byzantine bureaucratic process of buying it: as the favoured investment of the new class of high wage-earners in the Gulf oil states, land is expensive, from £ 4,000 to £ 10,000 an acre. British Airways architects, legal staff and accountants are now giving advice, stewardesses Maura McDonagh and Airdrie Armstrong have been seconded to run the London

end of the appeal and Pat Kerr herself has been 'dislocated' from the schedule until next September so that she can spend more time in Dhaka. She has become an integral link in the chain of command between the founder Sandra Simpson, in Canada, the orphanage and British Airways. Does she ever see herself devoting her whole time to the children? 'The answer is no. I can do them far more good within the airline than I could outside'.

Sometimes she worries because everything in the Dhaka orphanage seems a bit dirty and dingy, but the other day she visited Mother Teresa's home for the destitute disabled in Bombay. 'Ours is like a luxury hotel compared with the conditions they have to work in: it's almost reassuring to see someone having more problems. You have to accept you can only do your best. We're no saints, only ordinary people trying to help'.

(Anyone who wishes to contribute to the British Airways appeal should contact the Dhaka Orphanage Fund, TriStar House in 27 Heathrow Airport, Houston, Middlesex TW6 2JR. Cheques should be made payable to Dhaka Orphanage (British Airways Fund).)

(Reprinted with the kind permission from the Observer Magzine, 17th March, 1985).

Confidential Human Factors Incident Reporting (CHIRP)

Despite sophisticated technical equipment and elaborate personnel training, situations like: "I was lucky nothing happened this time!" continue to occur. As you all know, these situations are not unique. It is very likely that a very similar situation surprises somebody else. If the reason of the incident was a technical fault, it is very easy to make a report and trigger corrective action. However, if a human factor was involved the situation is almost certainly suppressed until it becomes fatal.

In order to get feedback of normally suppressed incidents the Confidential Human Factors Incident Reporting system (CHIRP) has been made available to British pilots. The participation of UK ATCOs is presently under discussion (TRANSMIT July 1984 p. 31). Also, dangerous situations which happen to others could be brought into discussion without offending a colleague. The Dutch pilots use an elected "Vertrouwensteam" for these purposes. They include as well human relation problems. Wouldn't such a system be useful for Eurocontrol. The technical committee of EGATS would like to hear your opinion and proposals.

The following article of Roger GREEN, principal psychologist at the RAF Institute of Aviation Medicine, gives a detailed description of CHIRP.

After any aircraft accident it is possible to find somebody to tell you that "it" nearly happened to them. The trick, of course, is to get them to tell you that "it" nearly happened to them before the accident, and this is the trick which all incident reporting schemes set out to perform. If "it" is a technical defect, then the problem is not too great as most pilots will happily report such an event. If, however, "it" is a pilot's own mistake, reporting it is clearly quite a different matter.

Many people (especially pilots?) find it hard to admit their mistakes even to themselves - how much more difficult it must be to report a mistake to the airline which pays you or the CAA which licences you. You must have a lot of faith in the understanding of your employer and have a very altruistic spirit to report your mistake if you feel that there is some balance to be drawn between the possible negative effects that such a report might have on yourself and the

general good which may result.

I think that there is another reason, though, why few human errors are reported at the moment. If you look closely at the sorts of mistakes that cause accidents they are often small, even trivial errors. They seem large only when they are followed by a catastrophe: if they aren't they are immediately forgotten. How can you get the pilot who nearly retracted the slats too early to imagine what the results of his error might have been and report it?

The solution to these problems which you, the reader, would probably suggest is to set up a new, confidential scheme to which pilots would be encouraged to report their mistakes and this is just what has now been done. It is being sponsored by the CAA but is is run completely independently at the RAF Institute of Aviation Medicine (IAM). By the first of December all commercial pilots and flight engineers should have received a reporting form and a note explaining the new system. The basic idea is that pilots will be encouraged to send in brief reports of the errors which they commit, or see committed, to a cell of just three people at the IAM. My credential for running the scheme is that, over the past ten years, I've been involved in a study which has looked closely at the human factors problems which caused nearly a hundred RAF and civil accidents. Roy Skinner and Phil Hayes are the other two members of the team who could, in the best sense, be referred to as old pilots. Although between them they have a broad aviation experience, none of us pretend to be experts. We have, for example, very little knowledge of air taxi or helicopter operations. We regard ourselves mainly as a postbox to receive your reports, disidentify them and pass on the meat to somebody who can do something about it. This might mean alerting the CAA to a problem, advising the operators of a certain aircraft type or even having a word with BALPA. However, most good might come from such a system by publishing the incidents (disidentified, naturally) and thus feeding back the information to line pilots. We intend to do this, but how often we do so will depend to some extent on how good the response is to the scheme. I hope that we will be able to mail such feedback to all commercial flight crew, but as there are around 10.000 of you out there I'll have to do some fast talking to find even the cost of the stamps.

We fully realise that for a system like this to work you have to trust us to honour the promised confidentiality. We do ask on the form that someone making a report should give his name and address, but this is simply to enable us to contact him in case there is something about his report which is not clear. As soon as we are happy with the report the name and address section of the form will be detached and set back, as a receipt, to the reporter. We will keep no record of it. This is as much for our protection as yours as it means that, in the unlikely event that we are pressed by some heavy-handed lawyer to reveal details of a specific report, we can claim, totally honestly, that we have no way of identifying individual incidents.

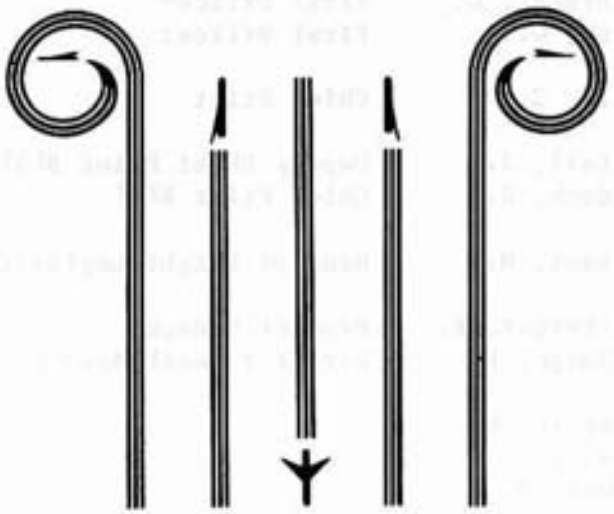
The other people who have to trust us, of course, are the operating companies and this is perhaps not quite so easy. They may have reasonable reservations about their pilots reporting mistakes outside the company. One airline suggested to us that the relationship between pilots and management on matters like this is a delicate one which they felt they had just about got right and they were concerned that some new scheme might upset it all. On the other hand, many operators have given total and unreserved support. We are sensitive to these problems and are anxious to have the operators on our side because we'd like them to let us use their crew-rooms to make our forms available to you. We obviously don't want to upset any existing applecarts, but we do think that it is important that pilots should have somewhere that they can report an incident which may be embarrassing to them, secure in the knowledge that such a disclosure will have no personal repercussions. Thus we expect that the incidents reported to us will be the incidents which are not at present being reported. We are setting out not to supplant any existing schemes but to do whatever we

can to supplement them.

One question that has been asked by a number of people is what sort of report we are expecting to receive. Clearly we don't want to receive reports of technical defects, these are already dealt with quite satisfactory by the CAA Occurrence Reporting Scheme. What we would like to hear about are those incidents where you make a mistake and you can see that the design of a piece of kit, the nature of an operating procedure, or perhaps the relationship on the flight deck made it easy for you to make that error. Even if you feel that you made the mistake for no apparent reason we'd still like to hear about it as you never know, we may get several people independently reporting the same sort of apparently unaccountable error and this should be sufficient to sound off an attentiongetter for us.

You probably know that there are already schemes like this in the States (ASRS) and in the RAF (CONDOR), and they do seem to be working well. This scheme could probably do with a snappy name too, and Confidential Human Factors Incident Reporting (Procedure?) does lend itself to "CHIRP", though you may have noted Roger Bacon's observation in his column in Flight that "chirp" does sound a bit like "squeal" and "grass". If it does, then that's bad luck, because this scheme has been conceived with the best intentions and we three who are going to run it are determined to give it our best shot. Even so, the success of the project clearly depends on you. It is pilots and engineers who will contribute to the scheme and it is they who will principally benefit. I hope that between us we can make it work, and if it does, I am convinced (as Sir Robert Mark says) that CHIRP represents a major contribution to flight safety.

IFATCA 85
ATHINAI



* In 1985 IFATCA gained three new members, viz. Antigua/Barbuda (to your atlas please!), San Salvador and Swaziland, but also lost three: Peru, Sudan and Venezuela (which did not pay for the last two years). Sri Lanka and Mexico had not paid either, but have asked for special arrangements which were accepted.

* Uli Windt from Bremen ACC replaces Ian Finlay (UK) as Vice President Administration.

* Among others the new phraseology was discussed in the Technical Committee. The ICAO representative stated that "radar contact" was replaced by "identified" and not by "radar identified".

* In 1987 all airlines will use three-letter instead of two-letter designators.

* Simultaneous transmissions and blocked frequencies were also discussed at length. No solution, neither procedural (monitor 121,5 or a special regional guard frequency) nor technical (override receivers, CONTRAN), was considered suitable.

* The United States just ordered 137 (yes, one hundred and thirty seven!) mode "S" radar stations. In Europe mode "S" simulation will take place in Brétigny between 3 - 28 June 1985. Things are moving quite fast!

* IFATCA still has strong reservations with respect to a reduction of lateral - and longitudinal separation, as proposed by ICAO.

* A topic of prime interest to EGATS - early retirement - was dealt with in the Professional Committee. IFATCA is in favour of early retirement for ALL controllers and a recommendation to that effect was accepted unanimously (so as well by GATCO).

* An ICAO plan, called "contingency measures", provides for the delegation of airspace of one State to another in case of a crisis. IFATCA has shown strong concern about this plan and its possible consequences.

* The controller's legal liability is another immense topic still being studied by IFATCA, in which EGATS assists through Ted McCluskey.

* Conclusion. The conference had an excellent working atmosphere. Kees Scholts and Gert Horsman represented EGATS in Committee A, Jan van Eck in Committee B, and Fred Le Noble and Appie Bonne in Committee C with Ted McCluskey and Jürgen Ellerman as helpers. I was responsible for the overall coordination. The social side was quite pleasant as well despite the weather: yes, it can rain in Greece! Next conference: San José, Costa Rica.

* On the return leg most of the delegates stopped for one night in Budapest where we were welcomed warmly by the controllers. Fraternity among controllers still exists: IFATCA proves it.

Philippe Domogala.

Appendix 1

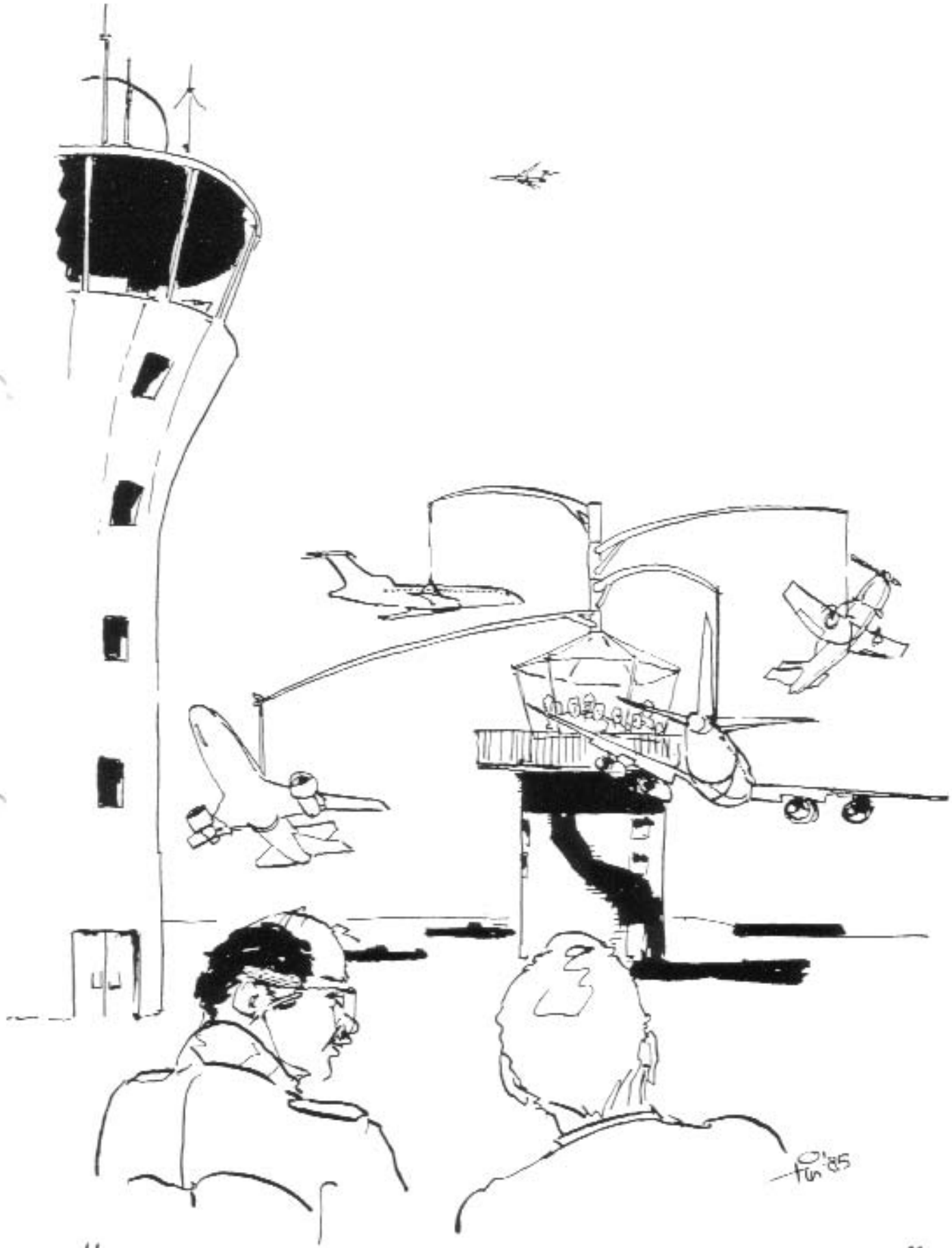
LIST OF EXTERNAL PARTICIPANTS

Company/Organisation	Country	Name	Function
Advisory-Group Air Navigation Services	European	Fischer F.	President
Aero Lloyd	West-Germany	Fast, U.	Captain
		Gagelmann, E.	First Officer
		Odebrecht, G.	First Officer
		Wirth, G.	First Officer
Air Belgium	Belgium	Rikir, G.	Chief Pilot
Air Europe Ltd.	United Kingdom	Nuttall, J.	Deputy Chief Pilot B737
		Baldock, G.	Chief Pilot B757
Air Inter	France	Thivant, M.	Head of Flight Logistics
A.K.G. Acoustics GmbH	Austria	Bolnberger, R.	Product Manager
		de Ruigh, P.	Director Dutch Agency
Amateur Radio Operators	The Netherlands	Moeshart, H.	
		Maes, F.	
		Hovers, H.	
Association Professionnelle de la Circulation Aérienne	France	Thoumazeau,J.F.	Air Traffic Controller
Austrian Airlines	Austria	Hohn, M.	Captain
Belgian Guild of Air Traffic Controllers	Belgium	Schodts, E.	Vice-President

Company/Organisation	Country	Name	Function
Braathens SAFE A/S	Norway	Larsen, A.	Captain/Flight Instructor
		Angermo, A.	Captain/Flight Instructor
Britannia Airways Ltd.	United Kingdom	McDougall, R.	Operations Director
		Sharples, C.	Chief Train.Captain B737
		Myles, R.	Captain
Britisch Caledonian	United Kingdom	Barker, D.	Captain
Brit. Midland Airways	United Kingdom	Forman, I.	Deputy Fleet Manager F27
Busy Bee of Norway A/S	Norway	Spockeli, G.	Chief Pilot B737
		Knudsen, J.	Captain
		Larsen, C.L.	Captain
Clement Clarke International Ltd.	United Kingdom	McNaughton, J.	Chief Designer
		Hall, W.F.	Senior Developm.Engineer
Cockpit(German Pilots Association)	West-Germany	Kröger, U.	Member ATS Study Group
Condor Flugdienst GmbH	West-Germany	Döhler, H.	Check Captain
Contran	Singapore	Corrigan, N.	Chief Designer
Crossair	Switzerland	Forster, M.	Flight Operations/ ATC Relations
Dan Air Services	United Kingdom	Leonard, D.	Captain
		Willis, R.	Operations Manager
		Goldring, R.	Captain
		Marks, C.	Operations Supervisor
Finnair	Finland	Eloranta, J.	Assistant Chief Pilot DC-9
Flugsicherung-System-Beratung	West-Germany	Fischer, H.	Air Navigation Services Consultant
Fokker	The Netherlands	Govaerts, C.	Tactical Coordinator/ Flight Operations
German Air Traffic Controllers Association	West-Germany	Fischbach, W.	Technical Matters
		Stumbaum, U.	Technical Matters
Guild of Air Traffic Control Officers	United Kingdom	Stock, C.	Director-Technical
		Green, E.	President
Hapag-Lloyd Flug GmbH	West-Germany	Behrendt, H.	Chief Pilot
International Aeradio Ltd-Data Communications	United-Kingdom	Fox, A.	Div.Manager Voice Systems
		Mouradian, R.	Sales Controller
International Civil Aviation Organisation	France	Arcangeletti, W.	Technical Officer/COM
KLM Royal Dutch Airlines	The Netherlands	de Bos, R.	Communications and Navigation Adviser
		Plukkel, G.	First Officer B747

Company/Organisation	Country	Name	Function
Linjeflyg AB	Sweden	Osterlund, H.	Manager Flight Procedures
LTU Lufttransport-Unternehmen KG	West-Germany	Achenbach, G.	International/ATC Relations
Lufthansa	West-Germany	Francke, J. Rahmann, H.	Captain First Officer
Martinair	The Netherlands	de Kolf, D.	Captain
McAlpine Aviation	United Kingdom	Minshaw, D.	Captain
Monarch Airlines Ltd.	United Kingdom	Richardson, D.	Chief Pilot
Nationale Luchtvaart School	The Netherlands	Minoli, J. Nolke, E. Helsloot, E.	Chief Instructor Instructor Chief Synthetic Training
NLM CityHopper	The Netherlands	Marijnen, H.	Captain F27
Orion Airways Ltd.	United Kingdom	Marvin, J.	Deputy Chief Pilot
Philips Aviation	The Netherlands	Blonden, F.	First Officer
Plessey Displays Ltd.	United Kingdom	Gardner, M. Field, A.	General Sales Manager(ATC) ATC Services and Systems Consultant
Royal Netherlands Air Force	The Netherlands	Kessels, P.	Lt. Kol.
Rijksluchtvaartdienst	The Netherlands	de Lange, J. van de Heuvel, R.	Assistant Controller Air Traffic Controller
Sabena	Belgium	Marien, M.	Chief Pilot
Singapore Airlines	Singapore	Ellis, D.	Captain
Sterling Airways	Denmark	Kristiansen, E. Petersen, E.	Chief Pilot DC-8 Chief of School Training
Stichting Bedrijfsgezondheidszorg - Zuid Limburg	The Netherlands	Stekelenburg, M.	Occupational Health Officer
Trans European Airways	Belgium	Sobry, L. Claes, D.	Captain/Supervisor Air Bus A-300 Captain/Instructor B737
Transavia Holland B.V.	The Netherlands	Dikkers, H.	First Officer
Université de Franche Compte, Besançon	France	Robertson, F.	English Language Teacher
Vereniging van Nederlandse Verkeersvliegers	The Netherlands	Vermeulen, H. Lee, N. van Beek, W. Bakker, L.	Adviser International and Technical Affairs Captain/ATC Study Group Board Member Board Member

A spectacular "son et lumière" was presented to us by the Fokker company at the end of the forum. "Fokker on the Wing" was excellent! Congratulations.



.. "WE KEPT THE OLD TOWER FOR TRAINING PURPOSES....."