CONTROL

83–2

INPUT

the magazine of the
EUROCONTROL GUILD of AIR TRAFFIC SERVICES

CONTENTS

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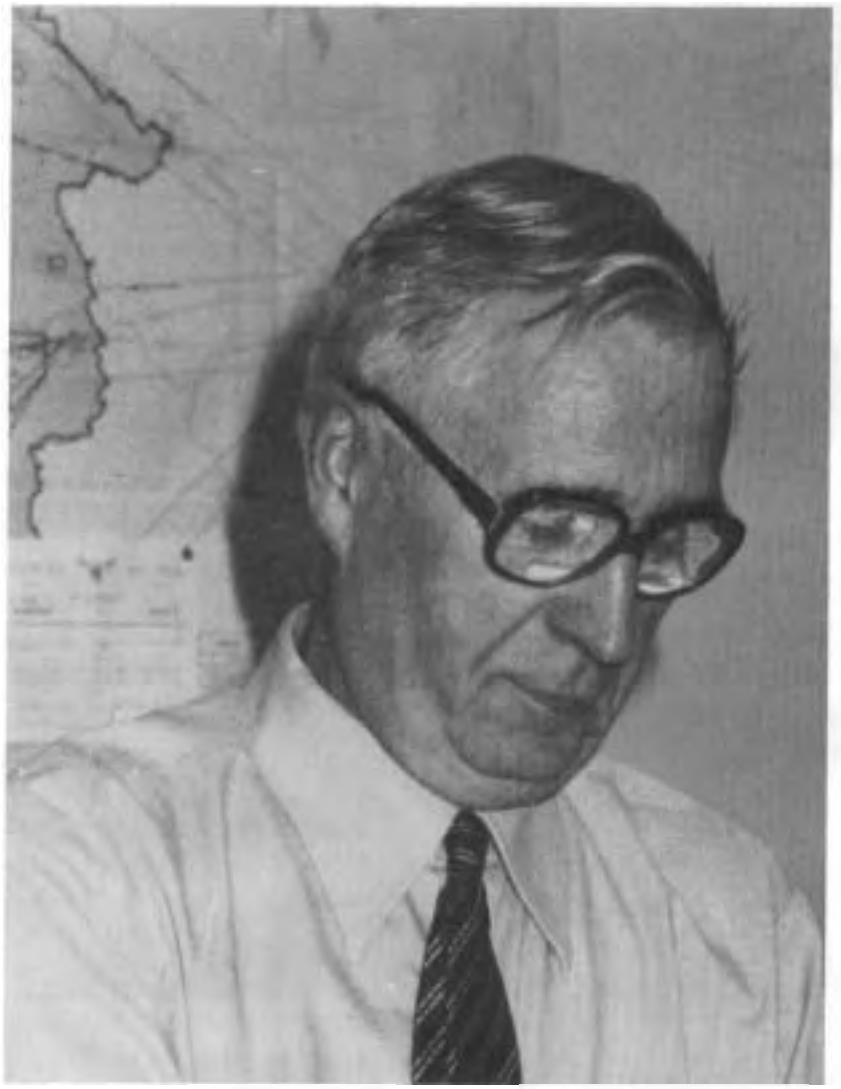


IN MEMORIAM

Roger Tamigniaux

1923 - 1983 (8.4)

For the oldtimers amongst us the death of Roger Tamigniaux must undoubtedly have recalled memories of the early days of the Brussels UAC. Roger Tamigniaux was indeed in charge of the small nucleus of controllers who left the Belgian Administration in 1965, to start what was commonly called "Brussels Upper Airways".
Though the flags of the member-states were not yet displayed in the rather dark and clumsy premises of the tenth floor in the Brussels Airport building, "Tammi" made it his task to accommodate us in the new Eurocontrol environment. He was simultaneously our chief of centre, current operations specialist, incident investigator and Head of Personnel.
For consecutive years "Tammi" acted as a link between the fragile unit at Zaventem and Brussels Headquarters. He dealt with both his staff and his superiors in a quiet and friendly way. In those initial difficult years he paved the way for our ultimate transfer to Maastricht in 1972 with determination.
Since 1971 "Tammi" was attached to Division 04 at Headquarters and though the contacts with his former colleagues became less frequent, he nevertheless actively followed the Maastricht situation and was often consulted about operational matters.
The last years of his life were spent in pain and agony. Many of us will remember "Tammi" as a real friend and a reliable colleague.
We offer to Mrs. Tamigniaux and to the family our sincerest condolences.

OUTPUTOUTPUTOUT

It has been suggested that EGATS should endeavour to support the inaugural activities of the Maastricht airport. In this respect Martin Germans designed a rear outer cover giving publicity to the airshow in September 1983. In addition it is worthwile to focus attention of the aviation industry on the main renovation activities which took place at the airport. An article highlights the immense operations which have led to the completion of a modernized airport, that can compete with other airports in the region.

At this point we would like to congratulate the air traffic controllers of Beek with a new milestone: since March 2nd, 1983 they operate from a new control tower. This offered us the opportunity to photograph the Eurocontrol building from a different aspect, as the front cover shows.

In this issue also attention for the position of our Jugoslavian colleagues and friends. We heartily hope that they and in particular the air traffic control system as a whole, will benefit from the more advanced equipment to be installed at several terminal and en-route control centres!

Finally I wish to invite the readers to give their comments, ideas and critisism in a letter to the editor.

Rob Bootsma

An Impression of Reims UAC

by Jan Gordts

It seems to be my priviledge to fill some of our quarterly issues with so called President's messages. The need for a typical message does not directly exist, unless I repeat myself desperately. Nevertheless I consider it useful to give you an impression of what I regard as an important event: the establishment of Reims UAC.

This new French ATC centre has a strikingly modern outlook; the building is hexagonal with rectangular extensions at each side. Our group of approximately 16 controllers was welcomed with champagne in a large circular conference room. After a friendly introduction we were audio-visually acquainted with the motives which had led to the decision to build this beautiful centre.

The main building contains the operations room and the systems room; the extended buildings shelter the offices and support services. Adjacent to the main building one finds the recreation area, which consists of a spacious canteen, a night canteen (self-service), a number of rest and sleeping rooms, some offices for the air traffic controllers' association and last but not least a gymnasium in the basement.

The operations room is 1100 m^2 large and well furnished. Although there are some circular windows, the curtains were partly drawn and the room was left in a cosy semi-darkness.

The noise level was very low, mainly due to the fact that only one quarter of the operations room was occupied by the sectors, whilst a future reorganization provides for more sectors. The floor-covering, lighting and furniture are nicely matching the modern wall and ceiling designs. The door- and windowframes in the

corridors are in vivid colors and the central heating is provided by small unobtrusive electrical elements.

In the systems room quite some activity was going on and large control panels with flickering lights remind the cautious technicians that all equipment is working properly. A smiling engineer gave a poëtic explanation of how everything was realized and what could be achieved in the future.

Back in the operations room we joined a group of controllers just about to go on break. The conversation went smoothly and sympathetically; both operational matters and duty rosters and social circumstances have been discussed. Older controllers in a nostalgic mood told us that the "ambiance" in Paris was "quand même different" and that Reims, though located on the golden hills of "la Champagne", could not possibly be compared with the "ville lumière". Junior staff who had just left the Toulouse training centre seem to wonder what career prospects they have in this brand new CCR.

Actually the Reims centre employs 200 staff members and most of them wear the standard ATC uniform: jeans and sweaters. We were surprised to see that a significant number of ladies was occupying the sectors.

In a final get together in the conference room everyone could express his views on what might improve the coordination between Reims and Maastricht.

At 17.00 we left with the impression that something had changed since we started in our profession some 20 years ago: ATC has changed the confines of the noisy, traffic congested metropolitan areas for the more quiet cities, where the living is cheaper.

We heartily congratulate our French colleagues with their new centre and trust that they will overcome their initial expatriation fever and will become well used to the customs of the beautiful Champagne country.

Brigadier Mário de Melo Santos
General Deputy of Air Traffic Control in Brazil
Airport Santos Dumont - 49 andar
20021 - Rio de Janeiro - RJ
BRAZIL

Ministério da Aeronáutica
Comando Geral de Apoio
Diretoria de Eletrônica e Proteção ao Vôo

Rio de Janeiro, March 14th 1983

Mr. J. F. CHARETY
General Secretary

Thank you for your letter dated March 06th 1983.

We haven't read the article published on the magazine "THE CONTROLLER" N9 1/82 concerning the situation of the Air Traffic Controllers in Brazil.

Anyway, the Air Traffic Control in Brazil subordinate to a Military Ministry, and the majority of the controllers are militaries.

All informations concerned to this area are classified matter. There is not here any association, similar to yours that demonstrates special interest on matters only concerned to domestics and militaries affairs of others countries.

Best regard,

Brigadier MÁRIO DE MELO SANTOS
General Deputy of Air Traffic Control in Brazil

VEREINIGUNG COCKPIT

EGATS
EUROCONTROL GUILD OF AIR TRAFFIC SERVICES

German Pilots' Association Visits Maastricht UAC

Report by Geoff Gillett

On Monday 7th March, 1983 members of the German Pilots' Association "COCKPIT VEREIN" visited the Maastricht UAC, having departed from Frankfurt by bus at 0600. Due to the fact that there had been such an overwhelming demand for participation in the EGATS Fuel Economy Forum in November of last year, this visit had been arranged by EGATS as a separate event.

PARTICIPATION.

Approximately 70 pilots and controllers had an opportunity to discuss subjects of mutual interest. This becomes more important in the need to understand each others tasks in our increasingly technical environment.

WELCOME BY PRESIDENT.

In his welcome address EGATS President Jan Gordts said that since the Maastricht UAC had been created in a rather remote corner of Europe, the controllers have been obliged to create an opportunity to meet the pilots. He said that we were most happy to welcome members of COCKPIT and that we considered it an essential task to promote pilot/controller dialogue, especially now when the aviation industry finds itself in such difficult economic times. With the ever increasing technology in the cockpit and in the ATC ground environment, we may find ourselves in professional ghettos unless we are able to continue to keep the dialogue in progress.

VISIT TO OPERATIONS ROOM.

Following an informative briefing by Mr. Feyens and Captain Kraft, the visiting pilots were given a comprehensive tour of the Operations Room, with detailed demonstrations of the MADAP System (Maastricht Automatic Data Processing and Display System).

PILOT/CONTROLLER DISCUSSION.

An excellent lunch arranged by Mr. Pierrard and served in the pleasant surroundings of the German Air Force Officers' Mess was followed by the transportation of the guests to the Euromotel Zuid Limburg, which was the location for the afternoon panel discussion. The chairman for this session was Mr. Walter Endlich, Deputy Head of Operations Division, who introduced the members of the panel namely: Mr. Klaus Dittmar (Hannover Sectors), Hptm. Kraft (MUAC Maastricht), Mr. Rob Bootsma (Brussels Sectors) and Captain Jauernig (Cockpit Verein). The secretarial services were provided by Messrs. Grew and Gillett.

The chairman emphasized that the discussion was to be of an informal nature and invited random questions from the floor. In response Mr. Wigglesworth asked about the blocking of airspace for military exercises and to what extent were the pilots hampered by this. Replying, Captain Jauernig said that such exercises are worldwide, but the impact was less significant in

the Maastricht Area than in some parts of the world, where flights by Heads of State can have a greater effect. OTL Maier, Senior Operations Officer MUAC Maastricht, said that in recent times exercises were being conducted at lower levels and now there are fewer constraints in German airspace.

Captain Jauernig introduced the next topic - the requirement to cross GMH at FL 230, whereupon Mr. Dittmar gave a full explanation of the difficulties arising when four ATC units are involved in the coordination of such flights inbound via this point to Frankfurt. Hptm. Kraft referred to the case of FOXTROT-departures which were sometimes held down unnecessarily because certain controllers did not use all the possibilities available to get such traffic released for uninterrupted climb. Captain Jauernig replied that there are controllers and controllers and pilots and pilots! He asked if it would help if pilots were to call the next ATC unit to obtain climb coordination. This produced some lively discussion, but generally it was agreed that such a procedure was to be discouraged. Mr. Ralston was of the opinion that better coordination was the real answer. Captain Denke, although finding it a little difficult to sort out his thoughts after a splendid lunch, said for safety's sake the rule must be to stick to the procedures on both sides. Too much of a "sportive" attitude could result in a reduction of safety standards. It was important to get common agreement on correct procedures. Mr. Busch said this would be easy - all we had to do was to get European ATC under the unity of Eurocontrol! But on a more realistic note he said that provided pilots communicated their requirements to ATC in good time, the necessary coordination could be achieved.

Captain Denke drew attention to the problems of the ATC boundaries and was looking for arguments to assist Eurocontrol who also had sector boundaries. Mr. Dieben, Head of Operations Maastricht UAC explained that national boundaries have to exist, inter alia, for legal reasons but Eurocontrol had achieved modification of the boundary between Brussels and Hannover UIRs by the delegation of airspace. Mr. Bootsma proposed at this point that perhaps a controller/controller forum was a necessity!

Captain Denke then raised the question of systems reliability and the testing of software. Mr. Gillett commented that the ultimate test of software was its extended operational use under heavy traffic conditions and no matter how thoroughly tests were conducted off-line, they could never cover all possible situations. Mr. Ehrmanntraut, Head of Systems Division Maastricht UAC gave an explanation of the design philosophy in the MADAP system. It was a basic concept that each software level was compatible with the previous one, so that if a catastrophic failure occurred, it would be possible to restart the system at the previous software level. The concept of parallel processing had no credibility at the MADAP design stage.

Discussion then turned to the value of giving "unknown" traffic information, during which an extensive exchange took place between Messrs. Kraft, Dittmar, Ellerman, Ralston and Domogala. It was explained that the majority of such aircraft were air defence controlled flights, sometimes resulting in controlled fright! But the pilots agreed that they appreciated information on such traffic. Mr. Lenglez made the point that when military pilots were making intercepts, they provided their idea of separation and were difficult to stop. We could not effect standard separation in such cases.

Next the discussion on the blocking of R/T channels by

airborne transmitters produced the information that IFALPA was pursuing the idea of an automatic cut-out device with an override facility. The pilots are apparently not in favour of monitoring 121.5 on their second set, which could provide a means of contact between ATC and aircraft on a blocked frequency. A question from Mr. Grew raised the possible use of SELCAL in such cases, but this too seemed to be of little value within our area.

On the subject of separation reduction above FL 290, Captain Denke informed us that IFALPA accepts such a reduction but would prefer a gradual change.

Problems associated with conflicting callsigns were dealt with and it was concluded that the best short term solution was to contact the Company Operations, requesting a change of trip number where confusion existed. The increasing use of "Q" as a callsign suffix was referred to as a "Quebec Libre" situation.

In an attempt to clarify some confusion about monopulse radar and Mode S, Dr. Von Villiez briefly explained the advantages that the new system would bring.

The chairman gave a resumé of the afternoon's discussion and concluded by saying that a better understanding of mutual problems would result from the day's deliberations.

CLOSURE OF DISCUSSION.

Jan Gordts in his closing remarks thanked the individual members of the organizing committee and the panel chairman for their services and wished the guests a safe return. In reply Captain Jauernig remarked that the service the pilots had received on the ground during their visit was as good as they were accustomed to receiving in the air! Most of the participants then adjourned to the Aero Club to partake of refreshment and to continue with an exchange of views in the more informal environment of the Club bar.

CONCLUSIONS.

Although the number of visiting pilots had been smaller than planned for, nevertheless this had provided for a much greater in-depth discussion on topics of mutual concern. In addition, a more personal briefing and explanation of our daily work was possible, due to the smaller size of the group. The pilots considered that such a visit to a technically advanced ATC centre was an essential part of their training. Furthermore, only if he had a good knowledge of the ground ATC environment, could a pilot fully exploit the ATC services. Ideally, they would like to sit in on some sectors, in both light and heavy traffic conditions and would welcome increased flight deck participation by controllers.

Once again it may be concluded that this EGATS initiative has been beneficial both to our professional image and in presenting the Eurocontrol ATC service in an optimum way to the users thereof. EGATS wishes to place on record our thanks to the Director of the Maastricht UAC, Dr. H.Von Villiez and his Heads of Divisions for their participation and for the provision of facilities. Similarly our thanks go to the Commanding Officer MUAC Maastricht, OTL. Sauerland and his staff for making available the facilities of the German Air Force and for their considerable assistance offered in the conduct of this visit, without which the event could not have been such a success.

An Automated Air Traffic Control System for Jugoslavia

by Anthony Freda, Jr.
(Eaton Corporation, AIL Division)

INTRODUCTION.

The Federal Air Traffic Control Authority (FATCA) of Jugoslavia is automating its Air Traffic Control facilities. Contracts have been signed with several international suppliers for Radar and Communications equipment. This equipment will be integrated with the Digitizing, Automation and Display Subsystems to be supplied by Eaton Corporation AIL Division.

The automation subsystems include:

- Radar Data Processing Systems (RDPS) for the Dubrovnic, Skopje, and Zadar terminal areas and the combined terminal and enroute installations at Belgrade and Zagreb.
- A nationwide Flight Data Processing System (FDPS) that will, under the control of a central processor at Belgrade, automatically print flight strips at proper sector control positions throughout the country.
- A complete Simulator/ Trainer System to be installed at Belgrade with a full RDPS to train controllers and maintenance personnel.

DATA ACQUISITION.

The Common Digitizer - 2 (CD-2) data format has been chosen as the standard for all radars. Primary, beacon, and weather video returns provided by the existing local radar facilities - from up to five long-range radars - are converted into digital messages that can be transmitted to the remote ATC centers.

RADAR DATA PROCESSING SYSTEM (RDPS).

The RDPS is a completely dualized system, with automatic fault sensing and switchover between computer channels. Its Belgrade configuration is capable of driving 18 Indicators, both TMA and ACC, with proper corrections to ensure registration with video and smooth synchronization of synthetic updates.

The RDPS includes the following operational and technical features among others:

- Multiradar Tracking
- Low-altitude Alert Capability
- Extensively Documented Modular Software
- Reflection Filtering
- Processing and Display of Weather Contours
- Total Scenario Recording for Playback and Analysis
- Automatic Tracking of 200 Targets
- Site-Variable and Design-Variable Parameters Grouped for Easy Access and Changes
- Automatic Correlation of Flight Data with Tracks

- Inter- and Intra-Facility Semi-Automatic Handoff
- Status and Control Unit for Automatic Fault Sensing, Printout and Switchover
- Full Line of Peripherals including Dual CRT, Printer, Dual Magnetic Tapes and Dual Floppy Disks.

The RDPS is divided functionally in two processors: a Multiradar Processor (MP) and a Display Processor (DP).

The MP can process simultaneously data from up to four sites. On each target one track is maintained for each radar site that senses that target. These tracks are called "site" tracks.

The aggregate of the site tracks is separately maintained. It is called the "composite track" and it is the composite track that is presented to the controller. The corrected position of the site tracks at the time of sensing is used to update the composite track. At the time of output, the composite track is projected out to the time of intercept of the reference scan with the target to ensure registration with display video and orderly synthetic presentation.

The DP capacity is 200 tracks, each of which may be maintained by target reports that originate from up to three of the active radars. Up to 40 of these tracks may be on primary radar targets. In addition, 200 untracked primary targets and 520 weather clutter plots can be accepted, filtered, sorted, and sent to the DP in synchronism with the reference scan.

Salient features include:

- Full Synthetic or Mixed Operation
- Tabular Data Areas
- Vector Maps Selectable by Pushbutton
- System Data
- Preview for Keyboard
- Coast/Suspend List
- Arrival/Departure List
- Full-scale Decentering Capability
- Trail History
- Built-in Cursive Character/ Symbol Generator
- Dual Keyboard and Trackball Capability.

FLIGHT DATA PROCESSING SYSTEM (FDPS).

The FDPS will include, at Belgrade, a dualized central processor with a full complement of peripherals and an Air Traffic Management Center (ATMC). Each ACC or TMA site will include Flight Strip Printers (FSP) and Video Display Units (VDU) at all control sectors. These equipments are interconnected through an operationally transparent Data Communications Network.

The FDPS will:

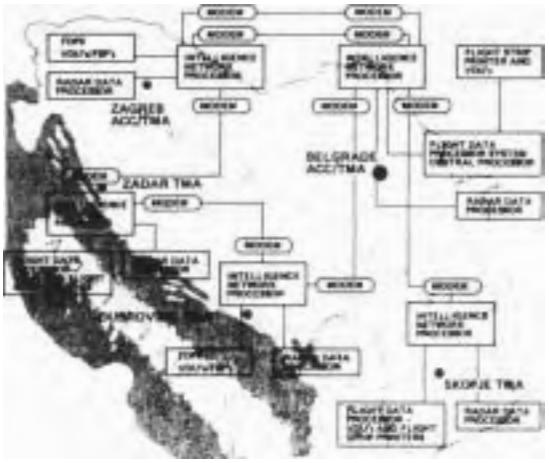
- Create and maintain a flight data base
- Interface with the Aeronautical Fixed Telecommunication Network (AFTN) to receive ATMC messages, and to transmit response messages to other AFTN locations
- Record all activated flight plan data to support the off-line statistical reporting function
- Automatically assign beacon codes
- Process and distribute flight plans to the ACC and TMA air traffic control facilities
- Interface with each RDPS to transmit flight plan data and receive RDPS configuration status data
- Allow certain operating personnel to modify data bases and systems control through a series of manually entered commands, while the system is on-line.

The FDPS will allow entry of flight plans from any VDU via manual keyboards. The AFTN flight plans or permission requests will be routed to the ATMC VDU's for display, and the operator will manually enter it via the keyboard while assigning the flight permission number.

DATA COMMUNICATIONS NETWORK.

The Data Communications Network interconnects the RDPS and FDPS at each site and with systems at the other TMA/ACC sites (see figure). The system utilizes Intelligent Network Processors. Intelligence is distributed throughout the network to provide centralized network control and monitoring of all modes, including the gathering of statistical measurement for performance and the detection of abnormal conditions when preset thresholds are exceeded. This approach allows the monitoring and detection of error conditions and enable simple rerouting through alternate prestored paths.

The RDPS and FDPS at each site are interconnected to provide flight plan data for automatic track initiation and allow automatic sector control reconfiguration with corresponding changes in flight strip routing. Semiautomatic



Intersite Data Communications Network.

handoff between ACC's or between ACC and TMA are accommodated by RDPS interconnection. Interchange of flight plan data extends to range of automatic track initiation from remotely filed flight plans.

IMPLEMENTATION.

On May 20th, 1983 the first system has been accepted by the Jugoslavian FATCA and it has just been shipped to Belgrade, where installation will commence as soon as the FATCA facilities are ready. This system consits of RDPS and seven controller indicators for both enroute (synthetic) and terminal (mixed model) control.

In June the ATC Simulator System and the automated flight plan processing system will be ready for acceptance tests by the FATCA in New York.

It is anticipated that all seven systems will be installed by the end of 1983.

CONCLUSION.

The integration of the mentioned subsystems with the planned implementation of modern Radar and Communications equipments should keep the FATCA ahead of ATC capacity and safety problems through the end of this century.

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SPLIT PERSONALITIES

ifatca '83

DEPARTURE.

On Saturday 19th March the EGATS delegation had planned to depart from Düsseldorf on an Inex Adria flight to Split. But the aircraft was full. Undeterred by such a basic problem, we found ourselves running across the tarmac to hurriedly board another aircraft, having left our luggage in the hands of the friendly girls from Air Intair for onward transmission later.

When airborne, we enquired from the stewardess about the destination of this particular aircraft, which turned out to be Zagreb! On arrival we were met by colleagues from Zagreb ACC and TWR who greeted us in a most welcoming way and ensured a top priority passage through customs and immigration. This was certainly the fastest entry into any country that we had ever experienced.

WELCOME TO SPLIT.

The next stage of the journey was to Split, where the approach necessitates flying very close to a mountain and if you look closely you can see where the wing-tips of preceding traffic have grazed the mountain side or at least that's what it looked like! Here too the welcome was wonderful and we boarded a bus to take us to the Hotel Lav some 30 minutes distant by rather narrow roads, where the conference was to be held within sight of the Adriatic Sea.

A PRECONFERENCE TOUR.

Following a very disturbed night during which the 800 or so delegates and guests were continuously arriving, the more sportive of your delegates took part in some gentle jogging prior to an informal tour of Split, accompanied by our hostesses from ATC. One of the outstanding features of historical Split is the Diocletian Palace, a unique example of Roman architecture constructed over many centuries. The cathedral dating from the 13th century is remarkably well preserved and the mass is still said in the Croation language, following a dispute with a long forgotten Pope.

As we were to discover, music is an important part of the culture in these parts. It was a rewarding experience to hear, that Sunday afternoon in the square, five part male voice harmony singing of outstanding beauty, though of course the meaning of the songs remained unknown. And so to the first official function - "Meet the Delegates" - where it was a pleasure to see familiar faces and to renew old friendships. The Controllers' Cup Football Tournament had of course taken place in Zagreb in 1980 during which firm friendships had been established between some of our delegation and our Jugoslav hosts.

From left to right: Fred le Noble, Adrian Enright (RVP W-Europe), Yure Kapetanovic, Geoff Gillett, Willem Pieneman, Ted McCluskey and Jan van Eck; kneeling: Philippe Domogala and Kees Scholts.

THE OPENING CEREMONY.

Monday morning saw the official opening of the 1983 Conference with welcoming messages by Mr. Mustafa Nazmi, President of the Federal Committee for Transport and Communications, Mr. Jordan Fanganel, Director General of the Federal ATC Authority, Mr. Ante Skataretiko, Vice President of the Executive Council of the Assembly of Socialist Republic of Croatia and Mr. Dragutin Matosic, President of the Town Assembly, Split. The President of the Jugoslav ATC Association, Mr. Jure Kapetanovic then welcomed all participants and wished us a comfortable and enjoyable stay in Split.

ORGANISATION OF THE EGATS DELEGATION.

For those readers who may be unfamiliar with the method of working at IFATCA Conferences, let me explain that the work is divided between three Committees:

- Committee "A" deals with Administration
- Committee "B" with Technical Matters
- Committee "C" with Professional Matters.

In addition a number of Standing Committees (S.C.'s) continue with the day to day work throughout the course of the year:

- SC I - Professional and Technical Matters
- SC III - Finance
- SC IV - Human Factors
- SC VI - Constitution
- SC VII - Legal Matters
- SC II and V being no longer in existence.

The EGATS delegation, under the overall Direction of Philippe Domogala, comprised Kees Scholts (Comm. "A"), Geoff Gillett (Comm. "B") and Fred le Noble (Comm. "C"). As decided at the EGATS AGM, Willem Pieneman was chosen to participate in the Comm. "B" work with a view to undertaking responsibility for this in the future. To complete the team, we had Jan van Eck, who attended the Conference at his own expense.

From left to right: Willem Pieneman, Geoff Gillett, Philippe Domogala, Kees Scholts and Fred le Noble.

SUMMARY OF COMMITTEE "A" SESSIONS.

IFATCA with current representation for approximately 10.000 controllers in 60 countries is experiencing increased problems in the use of the English language. Although this is the working language of IFATCA, there are large areas of the aviation world where its use is minimal. IFATCA will look into possibilities of having translations of some IFATCA documents, but at no expense to the Federation.

"THE CONTROLLER" magazine has been in financial deficit for some time and a committee

has been set up to reverse this situation by the end of 1983, Philippe Domogala being a member of this committee.

A proposal for bi-ennial conferences was once again defeated.

Following the PATCO dispute IFATCA policy was amended as follows:

a) Whenever a Member Association (M.A.) decides to strike, it should be only as a last resort and maximum notice should be given to airspace users.
b) IFATCA will support Flow Control Restrictions to that effect and will condemn any other M.A. that acts as a substitute for the striking M.A.

Due to internal economic problems, Mexico and Nicaragua asked to be suspended. It was decided that the 1985 Conference will be held in Greece in spite of a very enthusiastic request from Tanzania, which might have been a better choice in that it would have drawn attention to the appalling lack of ATC equipment in the continent of Africa.

The legal liability of ATC will be discussed in detail by ICAO this year and it would appear that many M.A.'s wanted EGATS to participate in the Legal Affairs Committee. Ted Mc. Cluskey was therefore nominated with Rob Bootsma as alternate.

The action in support of the Brazilian controllers initiated by EGATS is now supported by all M.A.'s and will in future be coordinated by Regional Vice Presidents (R.V.P.'s). The next Western European Regional meeting will take place in November in either Maastricht or Greece.

An increase in IFATCA membership from the present SF 19 to SF 22 per member was decided upon with effect from 1984.

SUMMARY OF COMMITTEE "B" SESSIONS.

Under the outstanding chairmanship of Mr. John Saker, who now retires having held that post for the past ten years, Committee "B" dealt with more than thirty working papers, among which the following items are of interest to our members.

Callsign Confusion:

Whilst it will probably be IFALPA policy to recommend alpha-numeric callsigns to ICAO, rather than the present system, tests conducted by Germany raised doubts as to the value of such a system.

SC I will continue to study the alpha-numeric proposals, although EGATS was in agreement with Germany in having doubt about any advantages. In the meantime, controllers should bring to attention any case of callsign confusion which should be notified to the Operators.

Frequency Blocking:

Once again EGATS tried to arouse some interest in this problem but only met with limited success. SC I will conduct a full review of the problem and will, if necessary, call upon EGATS to assist in this project, in the realisation of a technical solution.

Air Traffic Flow Management:

It is now adopted policy that air traffic controllers should participate in the planning, implementation and operation of any Air Traffic Flow Management service and that only controllers with recent operational experience should operate ATFM positions.

Dangerous Reduction of Separation:

In a working paper submitted by New Zealand on lateral separation, attention was drawn to circumstances under which the actual separation provided by the application of procedural separation could result in a situation with less than normal radar separation. Steps will be taken to draw this to the attention of ICAO.

Threat Alert and Collision Avoidance Systems (TCAS):

Much to the regret of the EGATS delegation, it was found to be premature to define policy on this topic. Since the introduction of such airborne equipment is imminent in the U.S.A., it does not seem to be premature to ask what would be the result if an airborne TCAS device suggests avoiding action to the left and a radar controller instructs an aircraft to turn right.

Amendments to R/T Phraseology:

Amendments to Annex 10 will probably become effective in November of this year. The controversial "Go Ahead" phrase will remain, but its possible deletion will continue under review.

Flight Management Systems (F.M.S.):

It was adopted as policy that:

a) Controller training should include instruction about FMS.
b) FMS should be programmed in such a way that they do not cause extra problems for ATC such as unexpected levelling-off during climb, in order to gain speed.

Action as a result of impaired safety:

Following a paper presented by Italy, it was recommended that SC I in conjunction with the Italian M.A. should circulate a questionnaire to determine where specific deficiencies exist within the ATC service.

Corporate Members Technical Exhibition:

Your delegation took full advantage of meeting and discussing a variety of subjects with the attending technical experts from industry. The Corporate Members make an important contribution to all IFATCA Conferences and provide an outstanding

opportunity to obtain up-to-date information on current and future developments. Provision has been made available in the Operations Room, via the Technical Committee File, of information gathered from the following:

ERICSSON - Display Systems
ISKRA - Telecommunications
RAYTHEON - Surveillance Radar
19 DECEMBAR - Hail fighting rockets
SELENA - ATC Systems
EATON - ATC Systems
WESTINGHOUSE - Radar
MARCONI - Radar
FERRANTI - Radar
COSSOR - Radar

SUMMARY OF COMMITTEE "C" SESSIONS.

For the information of all members, IFATCA maintains a library service which is administered by the Netherlands Guild. As a result of a paper presented by Switzerland, new policy was adopted for an "Air Traffic Controllers' Fitness Programme":

1) Administrations should set up fitness programmes available to all controllers on a voluntary basis.
2) No direct relationship should exist between such a programme and any annual medical examination.
3) Participation in such programmes should be carried out in duty time and at no expense to the controller.

Standing Committee IV will continue with their study of Ocular Diseases, ATC Working Conditions, the wearing of headsets and the effect on hearing and hygiene, prior to reporting back to Conference next year.

The possibility of an IFATCA sponsored scholarship scheme for ATC training is to be studied during the coming year.

An ad hoc Committee dealing with International Labour Office Matters made several recommendations which will give M.A.'s the opportunity of informing National Administrations about model contracts of employment and alignment of pilot/controller average salaries.

Since the Committee on Legal Affairs (SC VII) had produced little of value in the past year, a new group was formed. Italy presented a very interesting working paper on "The Limitation of the Legal Liability of the Controller", but the majority of M.A.'s favoured non-liability of the controller, which can only be a utopian dream. The opportunity was taken to draw attention to the in-depth study already produced by Rob Bootsma, dealing with some private law aspects of ATC liability. EGATS will be represented on the new SC VII by Ted Mc. Cluskey and Rob Bootsma.

SPECIAL CONTROLLERS HAM RADIO STATION.

During the Conference a specially licensed amateur radio station, callsign 4NOATC, was set up from the hotel. Approximately 1500 contacts with 50 different countries were made, among them communications from the EGATS delegation to the Deputy Head of Maastricht Operations Division, Mr. Walter Endlich, who was operating on mobile from the Eurocontrol parking area!

CLOSING PLENARY SESSION.

After five days of serious committee work, the time had arrived for the chairmen to make their final reports and to hand back their gavels to the President, Mr. Harry Henschler. For the chairman of Committee "B", John Saker, it was to be his farewell

Egats delegation leaving Split after the conference.

speech. Having served IFATCA for many years, the last ten as chairman of Committee "B", he said that he was almost at the age of 60 years and therefore officially senile! His services to the ATC world have been considerable and a standing ovation was evidence of delegates' appreciation of his untiring efforts to enhance the status of our profession.

A telegram regretting that he was unfortunately unable to attend the Split Conference, was received from Mr. Richard Weston, whose name will for ever be associated with the struggle for justice for controllers.

The presentation of a Scroll of Honour was made to Ted and Peggy Bradshaw, in memory of Ted who was killed in a road traffic accident during his preparatory Conference work in Jugoslavia. Mrs. Bradshaw, herself a tireless worker for IFATCA for many years, displayed great courage when she addressed the Conference after accepting the Scroll.

Captain Sansalone of Air Italia next addressed the Conference, since he was retiring as IFALPA ATS Study Group Chairman. He remarked that the Pilots' Association placed great value on a continuing relationship between pilots and controllers, and had a great respect for the work done by controllers in the International Federations.

In his closing address, the President thanked the Jugoslav Guild for their untiring work in producing such a well organised Conference. The final words came from the President of the Jugoslav Guild, Mr. Jure Kapetanovic, who paid a sincere tribute to the 20 members of his organising committee.

FAREWELL PARTY.

Now the time had come to relax. An excellent buffet, including some typical local dishes, was followed by an evening of singing and dancing of Serbo Croation and Dalmation folkloristic music. The energy and enthusiasm of the performers was nothing less than dynamic and we were left breathless in only watching the wonderful performmance. What thirsts were experienced in the warm spring climate of the Adriatic Coast. This required much research into the local products before we were able to positively identify "Poçip" as the best of the local wines.

RETURN TO BASE.

At 0600 your delegation left their beds and made their sad farewells to friends old and new. This really was a depressing moment. For some of us it was a first visit to Jugoslavia and we were totally overwhelmed by the friendliness of people who only a week before had been complete strangers. Yet from first arrival the impression of a sincere welcome had been there and had remained, thus making departure even more emotional.

DC9-82 of Inex Adria at Split.

In our return flight we were more fortunate. Another first experience for most of us was flying in the DC-9-80 of Inex Adria, surely the quietest and smoothest jet take-off and climb ever experienced. An opportunity was taken to inspect the advanced cockpit displays with digital presentation and to hear the opinions expressed on their use by the crew.

And then we were back in the familiar surroundings of Düssel-

The digitized cockpit of the DC9-82 of Inex Adria.

dorf airport with "nothing to declare", except a personal satisfaction that we had furthered the interests of our profession and had established some worthwhile friendships with colleagues around the world. Long will the memory of Jugoslavia remain with us and it is with great pleasure that the EGATS delegation has extended an invitation to our Jugoslavian colleagues to be our guests in Holland in the autumn of this year. It will be a pleasure to return their hospitality - it was a priviledge to be there.

Messrs. Domogala, Scholts, le Noble, Pieneman, van Eck and Gillett.

Editorial note: A full comprehensive report is available in the Guild locker.

"Maastricht Airport 1990"

An investigation into the expansion possibilities of "Beek" in the seventies revealed that the airport had good prospects. The location is ideal, since there is a population of some ten million people within a radius of 100 km, and tens of thousands of large and small industries are established in that area. Taking this into account, it is not surprising that Maastricht Airport is so proud of its activities.

Since the second week of May 1983, Zuid-Limburg has a new airport at its disposal. It is justified to use the word "new", as the expansion and renovation was so sweeping that the airport Beek, officially known as airport "Zuid-Limburg", is now well-known as Maastricht Airport far beyond our boundaries.

In the last three years great efforts have been made to give the airport a new outlook. The control tower, passenger terminal, runway and cargo centre are brandnew, and therefore it is reasonable to talk about "Maastricht Airport 1990".

A NEW CONTROL TOWER.

The old tower, with a height of only 7 meters, did not meet the requirements in any sense. Air traffic control had to live with the inconvenience of an

obstructed view, when some aircraft were parked on the apron.

On March 2nd, 1983 the Aviation Authority commissioned the new control tower, which is 27 meters high and offers ATC the possibility to overlook the whole airport unhampered, in spite of newly constructed airport buildings.

This year a start will be made with the installation of radar. The operational target date is autumn 1984. The use of radar for approach control will contribute to the provision of a more efficient air traffic control service.

A NEW PASSENGER TERMINAL.

Both interior and exterior of the passenger hall has a futurist appearance. The building is 90 meters long and 25 meters wide. Arrival and departure of passengers takes place at the groundfloor and taxfree articles can be purchased there. The offices of, among others, the airport services are established above the hall.

There was a need for extensive renovation since five travel agencies make use of the Maastricht Airport facilities. In 1982 the airport processed 100.000 passengers, 40% of them being holiday-makers.

A NEW RUNWAY 22-04.

The runway 22-04 was renovated over a period of 14 days continuous activity. Some 68.000 tons of bitumen and 15.000 square meters of concrete have been used. The 2500 meters long and 45 meters broad runway has been provided with an anti-skid coating. The thresholds have been widened and the runway lights have been renewed.

In 1981 Maastricht Airport was equipped with an ILS-system for ILS-approaches on runway 22. The approach on runway 04 in bad visibility is aided by a Papi-system. The strength classification PCN 71/F/C/X/T is sufficient for B747- and DC10-type traffic.

A NEW CARGO CENTRE.

It is clear that the most attractive feature of Maastricht Airport is its freight handling facilities. The airport is known as the "Memphis of Europe" and is now equipped with a new cargo terminal. The transhipment capacity is 40.000 tons a year, which can be increased, if necessary, to 80.000 tons a year. Close to the cargo centre 24 offices have been established, together with maintenance facilities. Taxiways and aprons have been reconstructed; as a result three wide bodies can be processed at a time. The following facts demonstrate that there was a need for these improvements.

The freight tonnage transported via Beek increased to more than 20.000 tons per year in the seventies. This included a great variety of commodities: Dutch, German and Danish cattle for Egypt and Kuweit; chicken and eggs for Eastern-Europe; electro-

Renovation of the runway in progress, seen from the air.

nic products, cameras, articles of art and textiles from the Far East; coffee, tea, leather and agrarian goods from Kenia, Ruande, Nigeria and Ethiopia.

Due to a reduction in trade and the prohibition of night flying the quantity of cargo handled reduced to just over 10.000 tons per year, but in 1982 it increased to 14.000 tons.

Aerolink, Express Parcel Systems, Hamilton Standard Stork BV and some other companies have established principal offices at Beek.

The airport is open daily for all types of aircraft from 06.30 until 23.00 and from 23.00 until 02.00 for a limited number of aircraft with a weight up to 5700 kgs. During the above hours a well trained airport fire service is present and can answer a call within 45 seconds. They have at their disposal one RIV, supplied with 225 kgs of powder, 200 litres of light water and 2 x 50 kgs BCF, and two cash-tenders with 900 litres of water/foam each.

For the winter period the airport is equipped with 4 snow-plows, 2 snow-brushes, 1 snow-blower and 1 de-icing vehicle.

FK27, the new acquisition of Express Parcel Systems.

Apart from its effect on other economic activities, Maastricht Airport is of great significance for the employment in Limburg, which explains why the Provincial Government attaches so much importance to the airport. In 1972 150 people were employed; this increased to more than 300 in 1981 and is expected to be near 400 by the end of this year. Besides the flying-school Aero-Limburg (also a charter-company), the "Nationale Luchtvaartschool" of Schreiner Airways was established here in 1978, resulting in the number of movements increasing from 40.000 to an average of 65.000 per year.

A good development for potential industries is the establishment of a custom-bonded warehouse. This offers the possibility to store foreign merchandise at the airport, without involvement of the custom authorities.

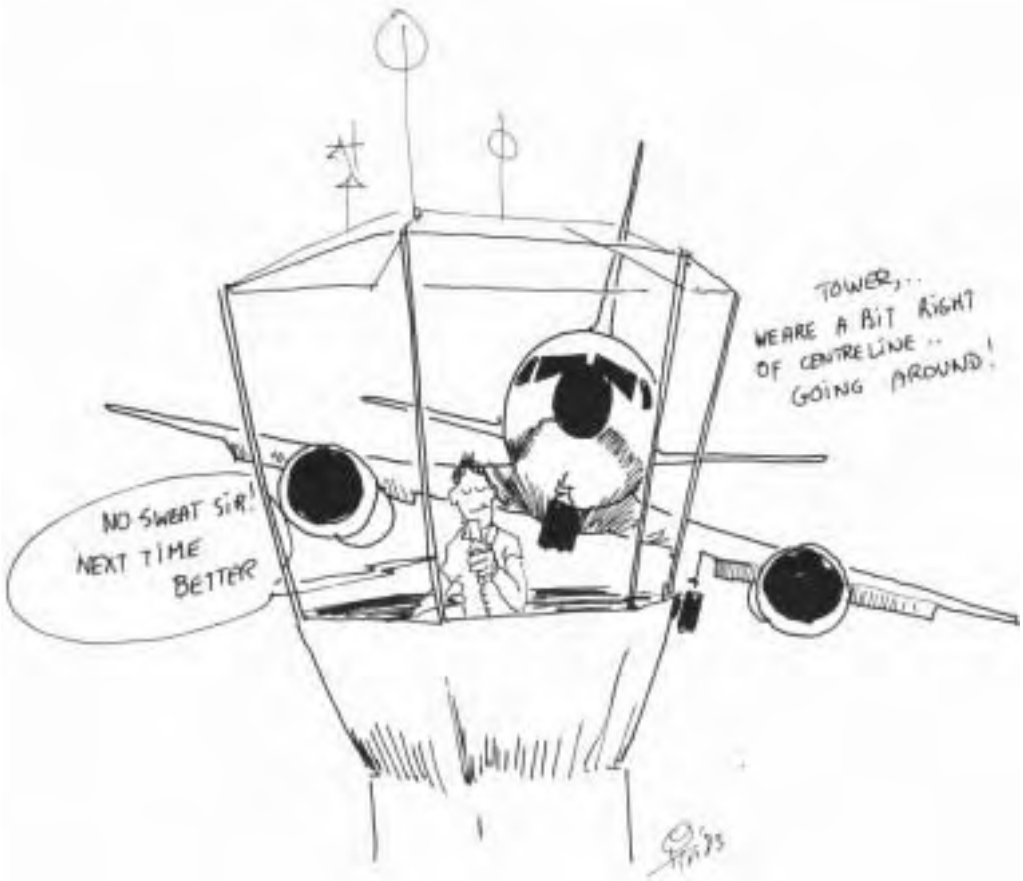
We may conclude that Maastricht Airport, which has the reputation for a quick and expert dispatch of freight, is one of the spearheads of provincial policy, a key-project for the furtherance of industrial development in Zuid-Limburg.

"Finding a Cure"

by Eurospero

I was on the bed half naked. This man, wearing an ultralight headset was asking for deep breaths when suddenly the telephone rang. "Excuse me", I said and he winced at the unexpected increase in decibels in his ears. I rushed to the insistent ring.

"Janussen, KLM" said a voice at the other end. "There's a chap here from Singapore who wants to talk to you about the R/T Frequency Blocking". This did not seem the ideal moment and since I had been suffering from voice failure problems as a result of some foreign virus, according to the expert with the lightweight headset, I apologized for my minimal modulation and



croaked "call you back and tell Singapore to standby" and returned to the examination scene. At the price of medical services these days, I had no wish to incur a second mortgage by delaying the doctor.

Whilst Singapore was waiting, our local diagnostic was doing his trick with the lightpen in my ears. When it was all over he pronounced me officially sick. Till that moment it had only been a suspicion of mine, based on a blinding headache - (not related to the pleasures sometimes preceding such pain) - a pulse rate equal to three times normal and an inside temperature +38°. "Is there nobody at home to collect your medicine" he asked. "No", I replied, "my wife works part time so that we can pay your bills! But she can collect the placebos from your place later". One has to try to humour these medical people a little. It must be a hell of a life spending your days probing peoples private parts to earn your daily bread. My medicine man departed.

Back to Singapore. We had been in correspondence for some time following the Tenerife accident, though we had never met. Nigel Corrigan had replied to a letter of mine to FLIGHT-magazine, drawing attention to the problems of frequency blocking and simultaneous transmissions. Attempts had been made via IFATCA and EUROCONTROL to take up the problem but with little result. However, someone had found such matters to be important enough to pursue and now it became known that KLM is considering the fitting to a DC9 of a prototype device developed by Mr. Corrigan in Singapore.

"Sorry we shall be unable to meet - I have to catch a flight from Amsterdam this evening" he said. In my present condition I was in no state to dash to Schiphol for a further exchange of ideas; my own voice transmissions were now down to 2 by 2 - too garbled and too weak! "Have a good flight" I said, "I'll be in contact with KLM". I crawled back to bed and the consuming fire of the fever.

Some time later when Bo Derek, scantily dressed as a nurse, was about to place her cool hand on my hot head, I awoke.... But it was only the wife recently returned from her lowly paid, highly taxed, part time hobby which she calls work.

"Has the doctor called" she asked. "Yes" I replied, "and KLM, the milkman, two jehovah's witnesses (why do they always operate in groups?) and a chap from Singapore who wanted me to go to Amsterdam this afternoon". "Apart from that, I had a peaceful day. Now, please collect some prescribed potions from the local witchdoctor or you might be a widow before breakfast"!

So the turning points had been reached. Your regular reporter was about to be repaired and at last, attention is being focussed on finding a solution to a problem known to pilots and controllers for years. A problem which raises the blood pressure of any controller suddenly finding his R/T communication channel blocked by a stuck-on transmitter from an aircraft. Not at all a pleasant experience with twenty other aircraft on the frequency, some of them locked on radar headings. Furthermore the non reception or part reception of ATC instructions, caused by simultaneous transmissions has had disastrous results.

We are but at the beginning of finding a means to eliminate the dangers arising from such occurrences. Success to those who find that the search for improved safety is, though unspectacular, a highly worthwile pursuit.

Rescue Operations via Satellite

When technicians at the Goddard Space Flight Center in Maryland recently managed to pull America's newest weather satellite, NOAA-E, out of a useless tumbling orbit, Nasa and the satellite's maker, RCA Corporation, were not the only ones cheering. At least 32 others were glad to see the first American satellite with search-and-rescue capabilities put safely into a stabilised orbit. That is the number of individuals saved from shipwrecks and air disasters over the past nine months, thanks to an emerging multinational rescue-satellite network.

Until the NOOA-E launch, the so-called Cospas-Sarsat network relied on a single Russian satellite, Cospas-1, which could monitor and report to ground stations emergency transmissions only from parts of North America, Europe and the Soviet Union. Soon, there will be four satellites: a second Russian one is already in orbit and undergoing its final check-out, and the Americans plan another launch later this year.

Together, the four satellites will be able to receive and relay signals broadcast on the 121.5MH and 243MH frequencies (reserved for international distress calls) from anywhere in the northern hemisphere. If enough ground receiving stations are built, the satellites could pick up and relay distress calls right around the globe. At present, there are only 10 stations in the network: five in the United States; three in the Soviet Union; and one each in Canada and France. Fortunately, a number of other countries, including Australia, Brazil, Britain, Japan and Norway, are considering building rescue ground stations.

Why bother with such an elaborate system? The answer is its speed and accuracy. Although America alone has some 200.000 aircraft and at least 6.000 ships equipped with emergency position-indicating radio beacons, experience has shown that there is no guarantee even that their signals will be picked up - let alone lead to timely rescue. Nasa believes that busy cockpit schedules and the annoying noise associated with the distress frequencies have led pilots to turn up noise-eliminating "squelch" controls to the point where low-power or failing distress calls are inaudible - or to cease monitoring the channels at all.

Even if a pilot does pick up a distress call, he may have precious little idea where it came from. The radio-reception horizon of an aircraft flying at 40.000 feet covers an area of several hundred square miles. An expensive and time-consuming search effort often has to be mounted.

Time is precisely what the initial survivors of a disaster do not have. Typically, Nasa reckons, a rescue will have to be effected within eight hours of an air crash - and four to five hours of a shipwreck - if more than half of the victims are to live. If a rescue takes more than two days, only one in 10 will survive.

A satellite can pinpoint the origin of a distress call to within a radius of 12 miles. When all four satellites are in operation, detection by the existing ground stations of an emergency call anywhere in the northern hemisphere should be assured within two to three hours.

There are problems: not least, false alarms. According to Nasa, 95% of the "distress" calls being picked up are false alarms, typically test calls or transmissions from devices that have been activated accidentally. The technology to avoid responding to such calls is on board the satellites - but is not being used.

As well as being equipped to receive the distinctive "Wow-Wow" distress signals transmitted on the 121.5MH and 243MH bands, the satellites have computer proces-

sing and storage devices to deal with signals transmitted on the 406MH band. It is thought that this frequency could be used to provide information about the nature and circumstances of an accident - and to doublecheck the validity of a distress call.

The French, who have used the nearby 401MH frequency to monitor weather balloons and to track polar bears and elk in the earth's far north, have been exploring the data-transmission potential of the 406MH band. And manufacturers have already developed suitable equipment to beam data on the band, although only a handful of such radio beacons are in experimental use. Until there is an international agreement to test and work out the details of bringing the band into the Cospas-Sarsat search-and-rescue network, however, the satellite 406MH equipment will ride aloft in silence.

History, Development and Operation of Modern Profile Computers

by Captain Jens R. Francke
(Deutsche Lufthansa AG - Frankfurt/Main)

The following is an abridged version of a presentation to the last refresher course at the Eurocontrol Institute at Luxembourg in April 1983. The author aims at a deepening and widening of the knowledge of the parameters affecting an optimized flight operation from a pilot's point of view. Special emphasis is laid on the advanced technical airborne aids and their influence on the operation of modern jet aircraft, which is of consequence to the cooperation between pilot and controller, now and in the near future.

1. INTRODUCTION.

Commercial airlines have traditionally been among the most conscientious consumers and conservers of fuel and other petroleum products. They had ample motivation: the cost of fuel and oil accounts for 30 to 40% of the total direct operating cost of transport aircraft.

The worldwide discussion about oilshortage, production expectations and discovery of new resources prompted measures of saving fuel respectively optimizing consumption. At least two thirds of the undiscovered oil in the world is believed to lie in off-shore areas, but the cost of producing oil in these areas is four to five times the production cost on land. The cost of the production of fuel from tar, sands, oil shale and coal will be prohibitively high for the time being; on the other hand the price of conventional fuel is rising as well. This forces us to positive and concerted efforts to improve our conservation methods and programs in order to continue economic commercial air carrier operations.

While we talk about fuel-saving, we have to realize that the cost of fuel is not the only factor influencing economic operation. Flight time related maintenance costs, crew salaries and among others, time factors like aircraft rotation, crew rotation, maximum duty times and weather affect the timeproportional cost. After the oilcrisis in 1973/74 the relation of fuel cost to timeproportional cost shifted so much that improvements in fuel-saving were pursued by different methods, especially by a reduction of the average cruising speed.

Rather the specific airspeed must be determined so that the total cost per nautical mile reaches a minimum.

In general the fuel consumption of an aircraft depends on the aerodynamic characteristics and the engine itself. In this respect NASA, major airframe and engine manufacturers have pursued several investigative programs:

1. improved propulsion/airframe integration technique to reduce total drag (A310)
2. application of laminar flow control techniques, not only to airfoil, but as well to fuselage structures (A310)
3. supercritical wing design (A310 and B767)
4. incorporation of fulltime stability augmentation systems to allow reduction of empennage size with attendant benefits of reduced load and less trim drag
5. improved high bypass engine design.

In general, these are longterm programs which offer the possibility to reduce the cost of fuel by 10 to 20%. Although some of the technology can be applied to today's aircraft designs, these activities offer little immediate relief to the airlines in their current day-to-day operation.

The issue "how do we deal with today's airline aircraft" has not been adequately addressed. How do we improve the consumption of fuel without submitting to the costly alternatives of re-engining or re-equipping the fleet with more economic new aircraft? In other words, how do we salvage our investment in the aircraft that are flying revenue routes at this moment? The scope of the problem is enormous, since presently 1300 B727s, 700 B707s, 500 B737s, 300 B747s, 800 DC9s, 500 DC8s, 250 DC10s, 150 L1011s and 300 A300s are in airline operation. A large number of these aircraft represent new or recent investment by their operators.

2. DEVELOPMENT OF MORE ADVANCED EQUIPMENT.

Air traffic control can contribute to a large extent to the saving of fuel, especially by utilizing the possibilities offered by the most modern technical aids in the cockpit. In order of historical development the following technical methods are used:

a. Experience of the crew, Rule of thumb.
b. Operations Manual (tables)
c. Hand held performance calculator.
d. Computer disc.
e. Performance advisory computer (partly integrated in the cockpit).
f. Fully integrated Performance Data Computer System.
g. Flight Management System.

2.1. PERFORMANCE DATA COMPUTER (PDC).

Over the past 20 years there has been a steadily growing interest in the development of techniques for aircraft performance optimization. The NASA, as well as Boeing, were engaged in aircraft trajectory optimization in the early 1970s. Boeing in cooperation with Lear Siegler worked on a concept of a Performance Computer. Testflight results and highly refined analysis revealed that the optimal system would be a full-regime flight profile computer, driving target bugs in improved speed and thrust instruments. This configuration promised fuel savings of 2 to 7% for both B727 and B737. Representative configurations of the system at three different levels of complexity were chosen for an evalution of the impact of the various configurations on the workload of the crew. The evaluation was based on the number of individual tasks required to accomplish 21 selected flight management functions. The number required by current conventional methods using the aircraft operations manual resulted in 170 tasks as compared to 54 tasks with the PDC. A reduction in workload of 65% with increased accuracy.

Lufthansa has installed the PDC in the B727 and B737. The PDC offers preflight cost-optimized flight levels under consideration of aircraft weight, wind and temperature. It computes a route profile with about 2,5 mins. take-off thrust, ECON climb, ECON cruise and ECON descent. For very short distances, which would normally include a cruise segment, the system computes a cruise flight level that lies slightly below the altitude at which the climb and descent profiles intersect, thus providing a short cruise segment that serves a smooth transition between both profiles.

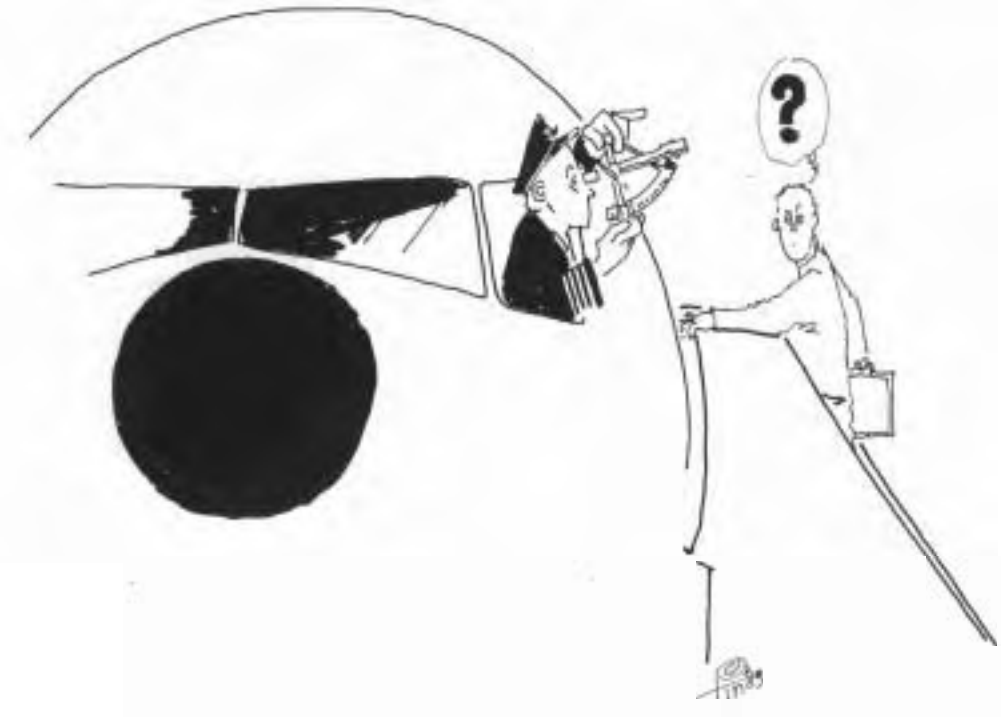
2.2. FLIGHT MANAGEMENT COMPUTER (FMC).

The Flight Management System is a sophisticated further development of the PDC, which only optimizes the vertical part of the trajectory, and incorporates the horizontal navigation by help of three inertia platforms based on lasergyros and utilizing VOR/DME signals for automatic updating and a databank in which the performance data of the aircraft and its engines, as well as the complete route network of the airline with SID, AWY, STAR, EFP (Engine Failure Procedure) and airport data are stored.

After insertion of the place of departure and destination and the aircraft weight, the FMC calculates a complete flightplan: route, altitude- and speedprofile and fuelcalculation. Computation targets may be varied according to the requirement: minimum cost, minimum fuel, minimum time. Parallel to the current flight progress strategic alternatives can be computed on the Control Display Unit (CDU), which is the interface between crew and computer.

The FMC offers:

a. Flight management predictions.
b. Navigation based on optional mixing of Radio and IRS (Inertial Reference System) signals.



c. Automatic lateral and vertical guidance via F/D and A/P command for pitch and roll, plus target settings for thrust by Autothrottle System.

The data base, sent by Sperry to the airlines, will be valid for 28 days and contains:

1. VHF and NAV aid records.
2. Waypoints by LAT and LONG.
3. AWY records, route and magnetic track.
4. Aerodrome records.
5. Aerodrome procedure records.
6. Company route records.

3. IMPORTANCE OF THE DIFFERENT ROUTE SEGMENTS.

One of the variables that affects overall trip fuel savings is stage length. In long-range operation the optimum cruise profile has the most prominent savings potential, although the descent profile is not to be underestimated. In short and medium range operation, the greatest savings potential is obtained by optimized climb and descent profiles, the descent profile having the greatest potential over the optimum climb.

3.1. BEFORE TAKE-OFF.

Some techniques can be applied which maximize fuel economy. With Lufthansa a reduction in the use of the APU (Auxiliary Power Unit) involves a savings potential of about 1,5 Mio DM/year for the A300 fleet alone. One minute less operation amounts to yearly savings per fleet of DM 240.000 for B737, B727 and A300; DM 170.000 for DC10 and DM 300.000 for B747.

Taxiing with part of the engines shut down results, based on a 2/3 use, in savings of almost 3 Mio DM/year for the Lufthansa fleet.

3.2. OPTIMUM CLIMB PROFILE.

In the past it was common practice to fly a constant IAS during climb. Nowadays we have adopted a method to differentiate the climb speeds dependent upon aircraft weight and cost-index. Ideally the climb speed should be ECON climb speed! Under circumstances, however, for instance when a pilot is instructed to expedite climb, he may choose between two speeds:

Maximum Rate and Maximum Angle. ATC can assist here by giving distance and flight level difference for better computation by the crew.

The climb schedule of the PDC furnishes:

- ECON - Economy climb with speed and thrust targets for cost optimal climb profile, based on the value of cost-index entered in the system, corrected for the wind.
- RATE - Maximum rate climb schedule for a climb profile that results in a maximum gain of altitude in minimum time.
- ANGLE - A maximum rate of climb in minimum distance = a point where a specified altitude can be reached.

Wind data in the PDC are entered either manually or automatically from Doppler or a DME-station and are displayed as headwind- or tailwind-component.

In addition to these computations the FMC delivers a graphic display in the map-mode where certain constraints will be met.

3.3. OPTIMUM CRUISE PROFILE.

The following differentiation can be made:

- Maximum Range Cruises (MRC). A speed dependent upon aircraft weight and altitude, at which the maximum specific range for a certain amount of fuel can be obtained. The relative low speed-stability at this speed requires a greater amount of throttle and is therefore not optimal. MRC allows the aircraft to fly the farthest.
- Long Range Cruise (LRC). LRC is defined as MRC minus 1% range under 0-wind conditions and gives greater speed-stability.
- ECON Cruise. In general, fuel-saving speeds are slower and incur longer flying times. The longest flight time would be based on a 0-cost index and would be Maximum Specific Range Speed. Higher than 0-cost indices result in MIN COST or ECON Cruise. This is todays standard speed as a rule.
- Standard Cruise. A fixed speed as opposed to a variable speed. The optimum profile speeds vary in all phases of flight in relation to aircraft weight and altitude, but it is impractical to fly at variable speed (calculations, flight plan, ATC). As a rule standard cruise speed is close to MIN COST CRUISE in the area of the optimum altitude.
- Minimum Drag Speed. Speed at which fuel flow is the lowest = maximum endurance speed or holding speed and minimum descent angle speed. At this speed the aircraft can remain in the air the longest.

The optimum cruising altitude for any configuration of an aircraft typically increases about 1000 ft with each hour of flying. The technique which allows the aircraft to climb slowly as fuel is burnt and its weight decreases, closely following the optimum altitude profile, is known as Breguet-cruise and is the fuel-optimal method of operating the aircraft in cruise. But the technique is seldom usable in todays air traffic environment, in which the aircraft's assigned cruising level is constrained to a narrow band of altitudes and subject to approval by ATC. Alternative altitudes can often be requested and obtained as the flight progresses. Exceptions are todays Concorde flights, which fly the ideal climb cruise profile across the Atlantic and thus making the crossing possible. Over Northern Canadian territory, flights bound for the westcoast are frequently cleared "between 33.000 and 39.000 feet".

The PDC offers in its flight level function continuously updated data for maximum and optimum cruise altitudes in the ECON, LRC and MANUAL speed profiles.

- ECON. Economy cruise, which furnishes speed and thrust targets for cost-optimal cruise operation, based on the value of the cost index entered in the system.

- LRC. Long Range Cruise, which furnishes speed and thrust targets for a range optimized cruise schedule.
- MANUAL. A manual data entry mode of operation, in which the crew can enter values of indicated airspeed or Mach number if a certain constant cruise speed is desired.

The RANGE and FUEL display present predictions of range in nautical miles and time in hours and minutes to the reserve plus alternate fuel level and to empty tanks for current flight conditions at the ECON, LRC, MANUAL, ENGINE OUT and HOLD cruise speed schedules. The crew may also enter alternative values for FL and wind to determine the effect of a change in these variables on range and endurance.

As an aid, up- or down pointing arrows appear on the scope when the actual FL differs more than 2000 feet from the optimum FL. The socalled "off optimum cruise penalty" in the ECON MACH profile, results in about 1% less fuel mileage per 1000 feet below optimum altitude.

Of course, the FMS can furnish the same calculations. In addition the FMC provides horizontal waypoints of any given number and can compute complete alternative flightplans by utilizing the databank (airways or direct routing). The influence of direct routings is quite significant, since the savings at FL 350 with an average weight per nautical mile are 22 kgs for B747, 16 kgs for DC10, 11 kgs for B707, 12 kgs for A300, 9 kgs for B727 and 6 kgs for B737.

The Diversion Problem.

When terminal conditions at destination degrade and the potential of a diversion arises, the crew is confronted with a variety of knotty problems. If I continue to destination on my present speed schedule, what will the fuel state be when I arrive overhead? How much more will I have if I fly a slower schedule? If I elect to hold, waiting for a possible improvement of conditions at destination, how long can I afford to hold? Which of my designated alternates can I reach from here, flying my present speed schedule? And how much further can I proceed towards destination before I must make the decision to divert?

The requirements of a safe diversion are usually very similar. They demand rapid and accurate assessment of the aircraft's performance capabilities at the time the diversion becomes necessary. A concise depiction is provided by both the PDC and the FMC.

A speed of .01 Mach faster than ECON cruise yields a gain of 45 seconds per hour, but will cost .7% more fuel; .02 Mach costs already 2% more fuel. And 1% fuel per fleet per year results in 4 Mio DM for B747, 5 Mio DM for DC10, 1.3 Mio DM for B707, 1.2 Mio DM for A300, 3.5 Mio Dm for B727 and 1.7 Mio DM for B737.

Engine Shutdown.

Similarly the crew has to find an answer to many questions in case of engine shutdown. What is the maximum FL that can be maintained with maximum continuous thrust on the surviving engines? Is a driftdown to this level necessary? If so, what is the best speed to assure a stable driftdown over the longest possible range? What FL can be maintained at LRC speed with maximum continuous thrust set on the surviving engines? What is the range capability of the aircraft for each of these conditions? The situation may be more complicated by terrain clearance problems, or by ATC's inability to positively clear lower cruising altitudes. The answers to all these questions are readily and rapidly available from the PDC and FMC.

3.4. OPTIMUM DESCENT PROFILE.

In short- and medium range operation the greatest fuelsaving can be realized by optimized descent profiles. The most economic descent is attained with ECON descent speed at idle thrust. The

parameters speed and Top of Descent (TOD) are relevant for the planning of an optim descent, and both parameters are functions of the aircraft weight and the windcomponent.

ECON climb speeds and ECON descent speeds do not overlap! Yet, the optimum descent can still vary considerably under the same marginal conditions. At heavier landing weights the descent must be initiated earlier, requiring the crew to make computations and adjustments to the TOD and speed schedule. In the past this was done by various rules of thumb: three times the altitude in thousands plus 10 miles is a typical, and often wastefully incorrect, approximation of the TOD, which ignores differences in weights. The wind component moves the TOD forward or aft. The location of the TOD with respect to the destination is particularly critical to cost economy. The penalty for initiating an early descent, for example 10 NM before TOD, is about 80-100 kgs. If one starts the descent 10 NM after TOD, the penalty is ca. 50-65 kgs.

As for climb and cruise, striving for ECON descent speed is essential. In selecting a certain descent speed, a definite glide angle is selected and therefore the matching TOD is fixed. This means that ECON descent speed is only economical if the matching TOD is selected.

Due to the high workload and limited possibilities suboptimization during descent by means of the manual is impractical. This is where the PDC and the FMC step into the picture and, especially for long range aircraft, the descent calculator.

The PDC computes and displays descent speed targets and distance to go, to provide cost-optimized descent performance for any selected speed schedule. The descent mode computations are based upon an accurately predicted value of the aircraft's landing weight, which is extrapolated continuously over the selected descent profile from its actual gross weight. They are also automatically adjusted for the effect of wind and any ATC-imposed speed/altitude constraints that may apply.

The computed profiles are designed to put the aircraft at an altitude 1500 feet above the destination field elevation and about 10 to 12 NM from the runway threshold, to provide adequate distance for deceleration to a stabilized approach configuration.

The presence of a headwind component during descent results in a steeper descent profile. Tailwinds will extend the descent over a greater distance. Yet, the FMC is again superior to the PDC, inasmuch as it shows in map-display the TOD in space and the PFD commands intercept point and speed to be followed.

Interruptions on short notice of an otherwise continuous descent started at the TOD, create a certain problem. Especially changes in remaining track mileage or prolonged intermediate cruise segments require thrust in low altitude and destroy descent optimization. This means that an economic descent can only be realized in cooperation with ATC. An additional level flight of 15 NM in 5000 feet altitude, for example, uses as much fuel as a complete descent from cruising altitude to final approach. This results in extra costs in the order of 210.000 DM per month for the 727 fleet alone.

4. GOAL.

In the application of fuel-saving procedures it is imperitive that the safe conduct of every flight remains the highest objective. In addition all decisions have to be governed by aspects of economy and schedule.

Should it be possible to save 10 kgs of fuel per flight segment, 30 kgs per stage, savings for the entire Lufthansa fleet would amount to ca. 6500 tons of fuel or 5.2 Mio DM per year.

Savings in the range of 3% on account of the PDC under normal ATC conditions would yield 16.000 tons of fuel or 12.8 Mio DM per year (B727 and B737).