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AIR RESCUE SERVICE IN THE FEDERAL  
REPUBLIC OF GERMANY -  
REQUIREMENTS FOR THE HELICOPTER

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With the rapid increase of motorized road traffic, the number of accidents in the Federal Republic of Germany also escalated. It was alarming to realize that approximately 20 % of the persons killed in road accidents died between the time the accident occurred and the time the patient arrived at the hospital.

With this in mind, some years ago the ambulances in various cities always took specialists from the hospital to the scene of the accident. Outside urban areas, however, gaps remained. It became obvious that helicopters would be more effective.

The main purpose of an air rescue system is to reduce what is called the "therapy-free interval" in all kinds of emergencies and disasters. Experience in emergency medicine has shown that the successful rescue depends more on the quality of the first aid rendered at the scene of emergency than on the speed at which the patient is transported to the nearest hospital. The rescue helicopter makes both possible. In addition, the fact that the smooth flight eliminates the risk of transportation traumata is a great advantage.

As part of a traffic safety programme the development of the civil air rescue service in the Federal Republic of Germany began in 1970 when the German Automobile Club, ADAC, put its first rescue helicopter into operation. This initiative was the impetus for the allocation of public funds. Today, there is a dense network of 33 air rescue stations covering nearly 80 % of the territory of the Federal Republic of Germany. Most of these rescue helicopters were provided for the Disaster Relief Service by the Federal Ministry of the Interior. Even the SAR service of the armed forces contributes to the expansion of the civil air rescue system by setting up 5 air rescue centers. But in the meantime due to the shortage of the governmental budgets it is becoming doubtful if this system can be extended by the state authorities. Therefore ADAC has mobilized his own resources again. In this way we offered the Federal and the regional Governments to set up new rescue helicopter stations in those areas, which are not yet reached by this service.

Recently ADAC established 2 more rescue helicopter bases. In order to have a total coverage of our country further more 3 centres are necessary. Plans are developed by ADAC to finish this programme within the next two years.

All rescue helicopters are integrated in the public emergency rescue system and function as an "extended arm of the hospital". They are stationed at well-equipped clinics and are on stand-by daily from 7:00 a.m. until sunset only for purposes of emergency missions. The infrastructure of a helicopterbase at a hospital comprises a hangar as well as a refilling station.

The rescue helicopter as the most expensive means of rescue should bring the most qualified aid. This means that each helicopter has an emergency doctor and a medical attendant on board. We do not believe, however, that telemetry can replace the doctor at the scene of emergency. The flight-physicians are specially trained and experienced in treating emergency patients. The medical attendant has also been trained for his task in this service. ADAC has developed guidelines for a special training programme with 55 lessons.

The reasons for stationing the helicopter at hospitals is to get the doctor on board as easily and as quickly as possible - so that the helicopter can be ready for take off within one or two minutes after the emergency call has been received.

The 3-men-rescue-helicopter-team is alarmed through the regional rescue control centre which is not located at the hospital. The job of this centre is to co-ordinate the missions using all rescue means in one region so that there is no competition between rescue helicopters and ground ambulances. As a matter of principle, anyone can call for the helicopter by dialing the alarm number of the rescue control centre. Most calls come, however, from the police. Police stations are obliged to alarm the rescue helicopter whenever traffic accidents occur unless it is absolutely certain that the persons involved have suffered only minor injuries.

The functions of the rescue helicopter can be divided into the following categories:

- a) Transportation of the doctor and the medical assistant to the scene of emergency to ensure optimum and speedy preliminary treatment to prepare the patient for transportation without any risk.
- b) Transportation of patients from the scene of emergency to the appropriate hospital. This is called primary transportation.
- c) Transportation of patients who have already received clinical treatment from one hospital to another which is better suited to final treatment of the particular case. This is known as secondary transportation.
- d) Transportation of life-saving medicines, stored blood or organs for transplantation.

e) Search flights are also carried out above lakes or in the mountains in case of missing persons.

The helicopter crew can be reached by radio at any time at the base hospital and during the flight. The helicopters are equipped with multi-channel radio sets which operate on all frequencies of the rescue service and the police. If a police car is already at the scene of the accident, the rescue helicopter pilot switches over to the police car's frequency, announces his expected time of arrival and is given information for landing. If a patient is transported in the rescue helicopter, the doctor gives the rescue control centre the preliminary diagnosis and gives the name of the hospital to which the helicopter is flying. The rescue control centre informs the hospital accordingly so that all necessary preparations for admitting the patient can be made.

Since a helicopter reaches its area of operations rapidly, the radius of action is limited to 50 km for each helicopter station. This distance is only exceeded in very exceptional cases. An evaluation shows that 80 % of the primary missions were flown within a radius of 30 km. The average flight time for primary missions is 31 min. and 65 minutes for secondary missions.

In most cases an ambulance is sent to the scene of the accident simultaneously with the rescue helicopter. Thus the doctor can transfer the patient to the ambulance after treating him and stabilizing him to such a point that his life is no longer in danger. In this way, the helicopter always remains free for urgent cases. In only 50 cases out of 100, patients are actually transported in the rescue helicopter. In the other cases the patient is taken over by the ambulance.

No flight is made dependent on a previous verification of a diagnosis. This would involve too much loss of time. The personnel in the rescue control centres have indication catalogues which facilitate a decision when it comes to selecting the proper means of rescue.

Expenses are met for all patients who are covered by health insurance, and in the Federal Republic of Germany, this is about 95 % of the population. ADAC has agreements with the health insurance companies and settles all accounts for the flights. This means that the direct operation costs of the helicopter, staff costs for the doctor and the medical attendant, accident insurance and medical equipment are not to be paid by the patient. The charge per flight is different from station to station and depends on the effective costs as well as on the number of flights which were flown annually.

Altogether, 32 BO 105 helicopters are used on our air rescue system. This type of helicopter has set standards in rescue flying in Germany. Intended as a multi-purpose helicopter, the BO 105 has two engines. Its maximum take-off weight is 2 400 kg. The helicopter has an average cruising speed of over 200 km/h with a range of 570 km. The maneuverability of the BO 105 is due to the Rigid Rotor System and the small rotor diameter (9.82 m). This factor in combination with the helicopter's short length (11.86 m) enables the BO 105 to land safely on a minimum space of 20 x 20 m. The main rotor's clearance (3.05 m) makes it safe to remain on a flat surface in the turning circle of the rotor. The high tail rotor makes it possible to land on uneven and overgrown surfaces.

Due to the 4-blade rotor, the BO 105 is virtually free from vibration. This is an important requirement for transporting emergency patients. The basic frequency of the BO 105 is 28 hertz and is thus well beyond those frequencies which could have a harmful influence on the patient's condition.

Patients are loaded through the rear doors into the cabin. The stretchers are positioned in flight direction next to each other so that the doctor and the attendant, seated at the head of each patient, can continue treatment during the flight. Placing the stretchers above each other, as is still customary in many other types of helicopters, has proved unsatisfactory as the doctor does not have sufficient room to work.

The medical equipment in the cabin of the BO 105 is within easy reach of the doctor and the medical attendant. On the basis of our experience the equipment was changed and improvements made. Medical equipment must be portable as it must be possible to render first aid outside the helicopter. Having medical equipment divided into three parts has proved practical:

- a) the doctor's emergency case which contains the most important medication for cases of emergency, plasma expander and bandages;
- b) the respiratory case with the necessary equipment to restore breathing and keep the respiratory ducts free;
- c) the emergency case for treating an additional 8 to 10 patients, plus a 5-liter oxygen tank with breathing mask and pressure indicator.

Two boxes attached to the rear wall contain emergency surgical instruments and medication which is less frequently used. Other medical equipment available on board includes a vacuum mattress, additional apparatus for therapy and diagnosis, a battery-operated suction device, one ECG with the possibility of registering results, a defibrillator and tools for freeing victims. Doctor's case, suction device and vacuum mattress are available in duplicate, so that they are ready for use from one mission to another.

Our 11 years of experience showed that not every helicopter is suitable for flying rescue missions. What is required at the scene of an emergency is not a "flying hospital" but a rescue helicopter which is compact and thus requires only a minimum of space to manoeuvre and can therefore land close to the patient. The following technical aspects should be considered:

- high maneuverability
- small external dimensions
- power reserve of the turbine engines
- vertical rising speed of 2,5 m/s
- high set main and tail rotor
- skid type landing gear
- easy loading and unloading for the patients
- two stretchers on the same level side by side
- low vibration
- low external noise
- two-way intercom system for pilot, doctor and medical attendant

The rescue helicopters should be equipped with two engines since they almost always fly below the safety altitude in order to save time and are forced to land at hospitals which are usually located in densely populated areas. At cruising altitudes of 150 to 200 m above ground, the pilot of a single-engine helicopter hardly has any chance of being able to head for a suitable emergency landing field with autorotation. The engines in twin-engined helicopters must work independently of each other and both engines must have sufficient margin of power so that in case one engine fails, the flight can be continued with a drive unit.

Flying rescue missions make very heavy demands on the helicopter. The following operational and technical aspects are also of great importance:

- high mission readiness, high reliability
- fast take-off capability
- easy mission preparation
- low daily maintenance requirements

As a result of operating rescue helicopters in FRG the national committee for standardisations has fixed the requirements so that helicopters can be selected in future for the rescue service.

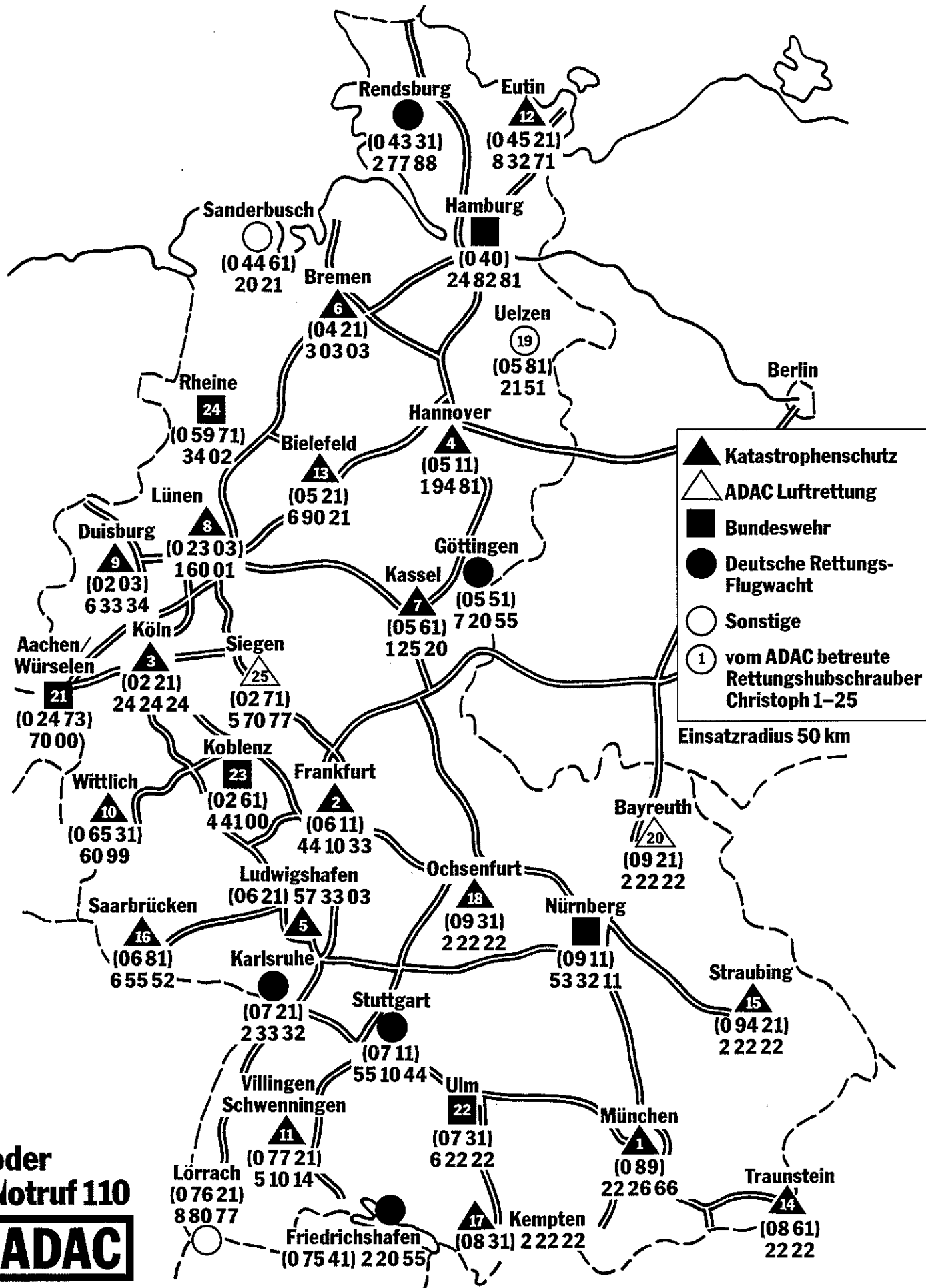
Since the foundation of the civil rescue helicopter service in 1970, 110 000 rescue missions have been flown. In 1981 alone, 20 000 flights with 10 000 flight hours were flown. Each rescue helicopter receives an average of 5 emergency alarms daily. The maximum number received was 16. Helicopters stationed in urban areas are annually flying 1 000 to 1 400 missions. In rural areas, the annual average is 650 flights. Most of the rescue flights are flown during the holiday season, particularly in June.

In percentage terms, the missions were apportioned as follows:

Traffic accidents	40%
Accidents at work	10%
Internal emergencies	20%
Secondary transportation	20%
Miscellaneous flights	10%

According to doctor's estimates, the rescue helicopter in 10 - 15 % of the cases either saved a patient's life or was crucial in mitigating the consequences of the accident. So we are proud, that in the meantime at least 10 000 people survived only by that service.

# Die Stützpunkte der Luftrettung



oder  
Notruf 110  
**ADAC**

# RTH Crew



↑  
**Doctor**  
(Base hospital)

↑  
**Pilot**  
(National Guard)

↑  
**Medical attendant**  
(Rescue organization)

**ADAC**



# BO 105 Rescue Helicopter with Medical Equipment



Rescue axe

Defibrillator

Ear protection

AMBU respiration bag

Battery-operated suction apparatus

Resuscitation bag

Pulse meter

Detoxication bag

Set of pneumatic splinters

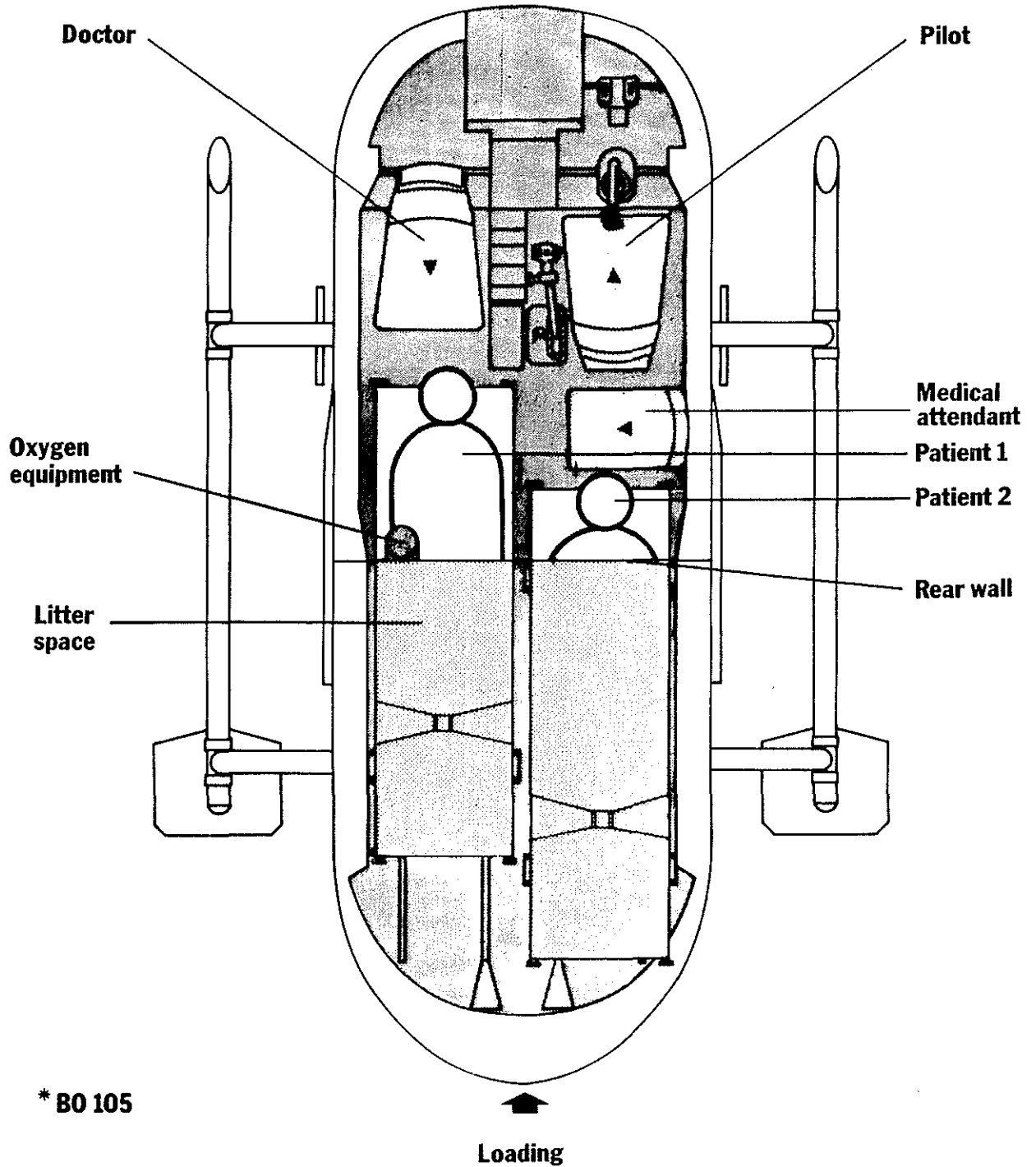
Infusion bag

ECG

Vacuum mattress

**ADAC**

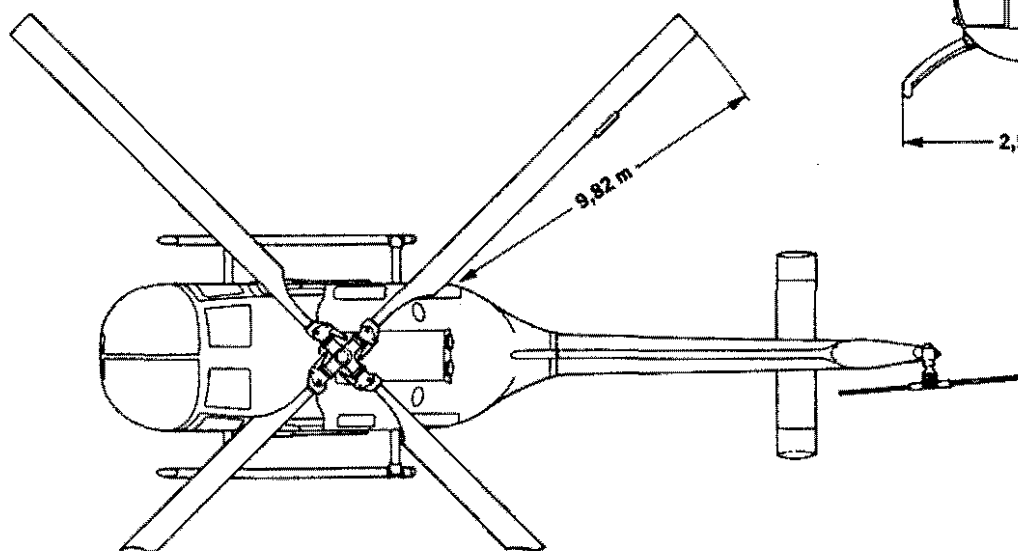
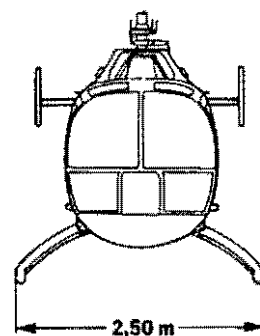
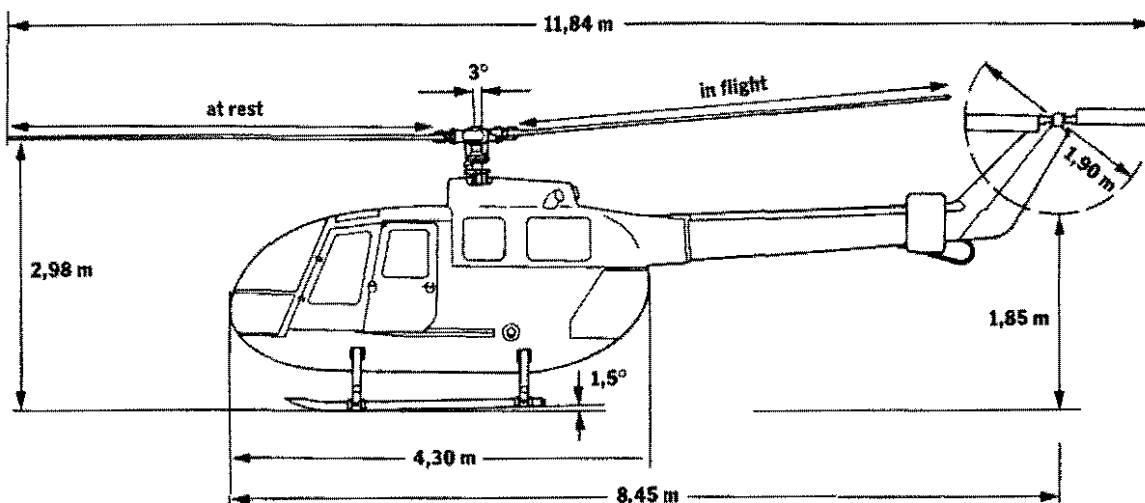
# Layout in the rescue helicopter \*



\* B0 105

**ADAC**

# Specifications of the rescue helicopter BO 105



**ADAC**

# Alarming the rescue helicopter



**Base hospital**

**Rescue control centre**

**Police**

**ADAC**

**Police car**

**Emergency  
call No. 110**

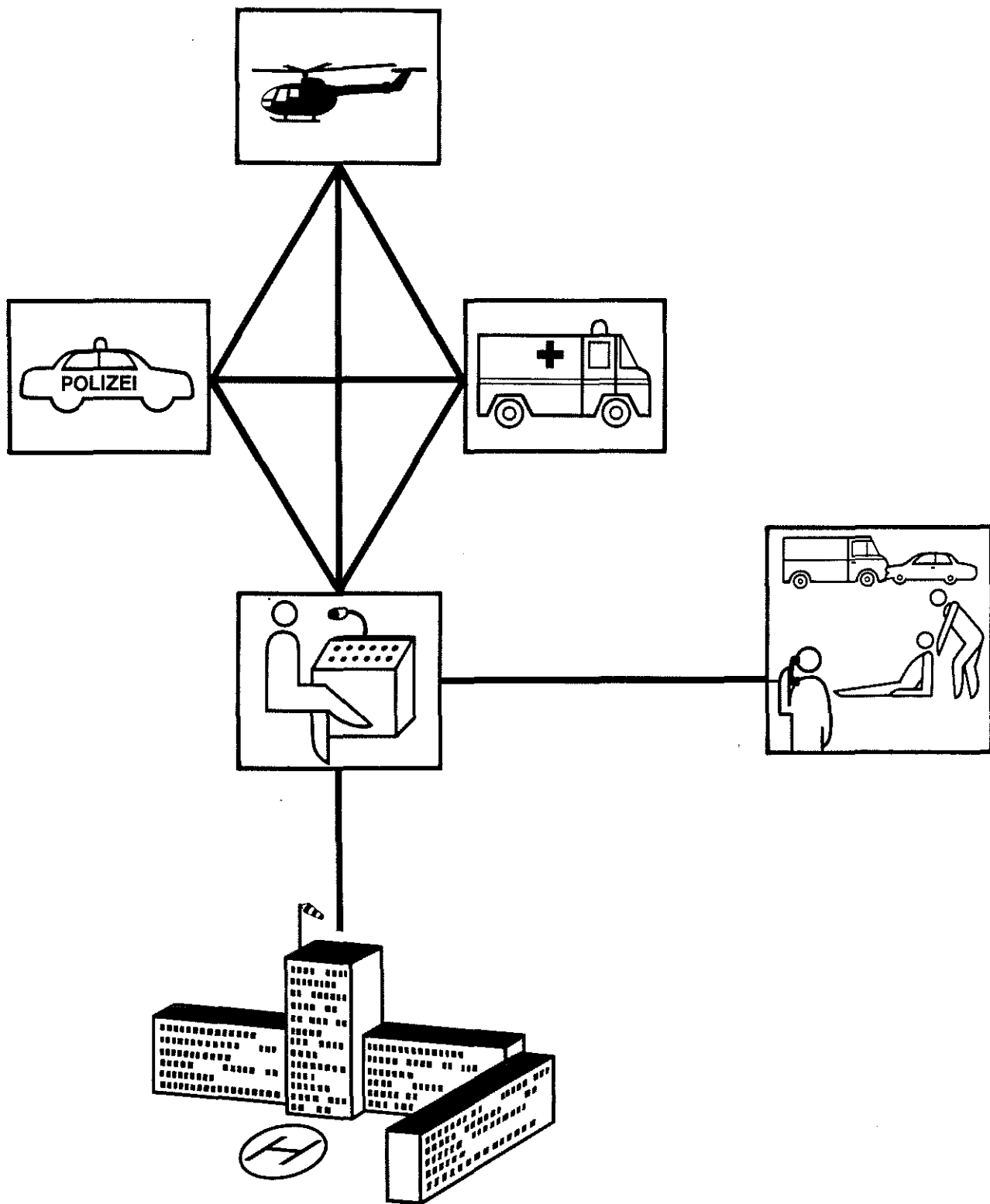
**Private  
telephone**

**Road Patrol**

**Ambulance**

**ADAC**

# Communication-System



**ADAC**

# Helicopter Flight Times

