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DIGITAL MAP READER FOR HELICOPTER

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1) ARMY HELICOPTER MISSIONS

There are four types of Army Helicopter missions :

1.1 RECONNAISSANCE:

The missions of scout helicopters is to locate armoured vehicules in order to allow command to determine the deployment and intentions of the enemy.

1.2 ANTI TANK HELICOPTERS:

Once the positions of the enemy tanks have been determined anti tank helicopters have the function of destroying them.

1.3 SUPPORT HELICOPTERS:

Face with the threat of enemy helicopters the function of support helicopters is to protect friendly helicopters. For this, they are equipped with cannons and Air to Air missile. They operate in nap of the earth flight.

1.4 UTILITY HELICOPTERS:

Their function consists in :

- assuring the support of the scout, anti-tank and support helicopters by supplying them with amunition and fuel.

- carrying infantry units up to combat zone.

1.5 ALL THESE FUNCTIONS ARE CHARACTERISED BY:

- the use of helicopters in group (Squadron),

- weather conditions : day, night, bad visibility,

- the necessity of N.O.E. flight, that is to say a few meter above ground level and among obstacles.

1.6 TYPICAL MISSION:

Even if the objectives of the mission of each type of helicopters are different it is possible to make a typical schedule for all missions. They each have the following characteristics :

- flight preparation,
- movement to the front line,
- specific mission (reconnaissance, anti-tank),
- movement to the rear.

During the rest of the summary we will examine the missions of anti-tank helicopters.

2) MAP NEEDS

2.1 ANALYSIS OF AN ANTI-TANK MISSION

2.1.1 Preparation of the mission :

It consists first of all in analysing the map with a view to :

- finding the best route wich will allow concealment (infiltration routes),
- finding the best firing position to destroy the enemy,
- finding the best retreat routes,
- finding obstacles to movement (pylones, lines ...)

It consists also in presenting on the map tactical information such as :

- position of friendly forces,
- enemy positions,
- particular tactical lines,
- positions of reserves (fuel, amunition ...).

2.1.2 Progress of the mission :

After take off the crew follow the planned route shown on the map. For this one crew member navigates that means that he constantly correlates particular points on the ground and their symbolic representation on the map. This task is very time consuming for the captain because if it is not done he risks becoming lost.

On arrival in the combat zone he has to choose quickly but precisely the firing position wich allows :

- maximum concealment from the enemy,
- to be at the maximum range of the missile,
- to see the enemy over the widest possible field of view,
- a safe retreat after firing.

All this necessitates a precise analysis of the map in a very short space of time.
After the crew will fly back to the rear.
The map is indispensable for the success of the mission.

2.2 THE MAP REQUIREMENTS

The crew need to refer to their maps permanently but the kind of informations they need varies with each phase of the mission.

TYPE OF INFORMATION / MISSION	SCALE	INFORMATION	
		MAIN	SECUNDARY
Preparation of the mission	1/200.000 1/50.000	Relief Main roads	Rivers Towns Forests Rivers
Movement	1/100.000	Relief Obstacles Vegetation	Towns Roads Rail ways
Firing phase	1/100.000 1/50.000	Relief Main roads	Towns Vegetation

2.3 CURRENT SOLUTIONS

2.3.1 Paper map :

This is the oldest and the most widely used solution. Its principal disadvantage is that it has different users ; it is drawn according to the needs of all potential military users. It is clear that the informations needed by a foot soldier, a land vehicle and a helicopter are not the same.
This has led map makers to present all information without priority.
For these reasons helicopters pilots during N.O.E. flight who needs primerely to know the contours of the ground will have great difficulty in finding this information among the other details on the map. It is the same for pylones, lines ...
Because of this disadvantage the crew will have to reduce speed in order to have time to navigate while the users demand that helicopter fly faster and faster.
Another inconvenient of paper map is the necessity for the crew to take several maps creating great problem when navigating at the intersection of two maps.
Another inconvenient is the fragility of the map wich become creased an unusable.
Last point the rate of updating is very slow (10 to 20 years). So that new roads or new power lines are not included on the map.

2.3.2 Map reader using film :

This uses maps stocked on films and presented on a video display.
This represents a great step forward because it is now possible :

- to change the scale of the map in 1 second,
- to "zoom" on a particular area,
- to link to the navigation system wich allows the permanent tracking of the helicopter's position on the map,
- to prevent the becoming worn,
- possibility of drawing tactical symbology on the screen.

But one disadvantage remains : the origin of the informations remains the paper map with its drawbacks.

3) DIGITAL MAP TECHNOLOGY

3.1 DATA

3.1.1 Digitized paper charts

This technique, based on optical scanning of existing maps, is used only when real databases do not exit for a specified area. The resulting display has no advantages over filmstrip analysis.

3.1.2 DLMS Files

These files are produced and maintained by western countries under a NATO-level standard. The coverage of Europe will be achieved by 1990.

They can be viewed as blocks of data describing regular areas of 1 degree by 1 degree in latitude and longitude. They contain two kinds of information : terrain elevation and features.

Terrain data consist of absolute elevations at the nodes of a 3 x 3 seconds of arc grid. So the resolution of these data is about 60 M x 90 M x 1 M in Europe.

Feature analysis data describe sequentially the objects which can be found on the terrain.

Each feature is mainly characterized by :

- position and shape (vectorized by pair of coordinates),
- nature and composition,
- predominant height above ground.

When combining the data contained in the two kinds of files, a variety of synthetic charts can be obtained, up to an equivalent of classical 1/100.000 scale.

Compared to standard paper charts, the only difference lies in the placenames, which are not included in the files. However, appropriate names can be added to the databases by the ground support of the system.

3.1.3 Satellite data:

For special areas of interest, recent and realistic data can be available for mission use. For exemple SPOT can provide files which are only a few days old and with a ground resolution up to 10 meters.

3.2 OPERATIONAL REQUIREMENTS

3.2.1 Traditional modes

Without any consideration of its technology, an airborne map generator has to fulfill following specifications.

- Hands off
  The map display must move continuously according to the aircraft movements (detected by the navigation system) without any pilot input.

- Adjustability
  On request, parameters of the map can be changed :
  - scale
  - orientation (north / heading)
  - centering and slew

- Overlay of mission symbology
  Both geographic and tactical data are to be displayed for a complete situation awareness.

- Navigation update
  By means of joystick and crosshairs, a point of terrain can be designated by the aircrew and its coordinates transmitted to the navigation system for updating.

3.2.2. New modes:

With the advent of digital technology, new modes are permitted for map generators :

Adaptive map

- terrain elevations will be shown in several manners color coding (absolute or relative to aircraft altitude), terrain profiles, shadings (computed in real time with a virtual sun),

- features will be selected by nature prior to display, according to the mission phase or to different needs of pilot and mission officer.

3.2.3 Performances

- mission coverage	90.000 Nm2
- display resolution	512 x 512
- display refresh	60 Hz non interlaced
- image computation	20 Hz
- scale change time	< 1 sec.

4) ADVANTAGES OF DIGITAL MAP READER

4.1 SELECTION OF INFORMATIONS

The digital map allows the pilot to see only that information which he needs in any particular phase of the mission on any particular flight conditions.

N.O.E. Flight

Can be assisted by the presentation of relief contours and obstacles with a the scale of 1/100.000.
Selected features (roads, railways) will only be presented when they are closed to the helicopter.
Particular zones could be superimposed to show flight restitution (ARTILLERY, ABC Zones)

ZOOM:

This facility allows the pilot to analyze the details of a particular area.

Adaptation to flight condition:

The map generator can display the specific requirements of all different flight conditions (VFR, IFR ...).

4.2 IMPROVED FACILITIES OF DIGITAL MAP

During low altitude phase it is now possible for the pilot to see the contours of the surrounding landscape (above and below) in order to avoid ground collision.

Visible and concealed features:

If enemy ground radar is present the crew can see at each moment whether their helicopter can be detected according to their position ; so they can determine the best flight path.

Before each anti-tank action the pilot can choose the optimum firing position because the system shows him directly if he will be visible to an enemy vehicle.

Because the system can shows the highest point of the area the pilot can easily choose the best radio communication points.

4.3 THREE DIMENTIONAL DISPLAY

On of the most valuable significant development of the system is that it has become possible with this system to represent the landscape as it would be seen in real life : i.e. in three dimensions. This type of representation is more natural.

The choice of a firing position now becomes easy because it is possible to simulate on the display the field of fire afforded by a given position.

In the same way the field of view of an enemy tank from a given position can be simulated.

An another advantage is the possibility of simulating all different flight paths during the preparation of the mission in order to select the most advantageous from the point of view of the concealment.

Even in darkness or very bad visibility it is possible to see a representation of the landscape well ahead of the helicopter's position.

4.4 POSSIBILITIES FOR FUTUR DEVELOPMENT

Given the development of digital map generator with the capacities mentionned above, it is now possible to envisage further refinements of the system in the futur.

- for example THOMSON-CSF is working on expert system to determine the optimum helicopter flight path in any given operation.

- information from other sensors (RADAR, FLIR ...) can be fed into digital map to produce a compound image presented on :

  head up display,
  head down display,
  helmet nounted display.

CONCLUSION

The development of the digital map generator reduces the workload of helicopter crews, allowing them more time to concentrate on their mission, the detection, the observation and the destruction of the enemy.