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THE GERMAN PASSIVE AIR DEFENSE SERVICES

by

Colonel K. G. Jacob (Retired)

Part II

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306 V. PASSIVE AIR DEFENSE FORCES.

The establishment of specific passive air defense forces started at a relatively late juncture. No mention of any such forces is contained in the preliminary plans for mobilization. The ruling viewpoint at the time was that the Safety and Auxiliary Service units in Category I passive air defense localities, and particularly motorized battalions of that service stationed in such localities for off-post commitment, were adequate to restore any damage caused by air attack and to handle any other pertinent missions.

The efforts of the Inspector of Passive Air Defense to convince the appropriate authorities of the necessity for specific passive air defense forces as a separate arm or service succeeded only when the air attacks against German territories reached large proportions, and when not only the Safety and Auxiliary Service units (motorized) had to be increased, but additional personnel also had to be made available for smoke-screening operations,[417] for the servicing of dummy installations,[418] and for the passive air defense supply installations and equipment depots.[419]

The Passive Air Defense Services comprised the following:

417. See VIII, d, 2, below.
418. See VIII, d, 3, below.
419. See VII, below.

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306 (a) Passive Air Defense Regiments,[420] containing a varying number of motorized battalions each.

(b) Smoke-Screening Battalions.

(c) Special Purpose Passive Air Defense Battalions, for the servicing and operation of dummy installations.

(d) Passive Air Defense Replacement Battalions.

(e) The Passive Air Defense School.

(f) The Passive Air Defense Instruction Company, organic to the Reich Institute of the Air Force for Passive Air Defense[421]

(g) Bomb Disposal Units.

(h) Passive Air Defense Equipment Depots (in personnel matters).

Personnel Strength. According to records of the Air Force High Command/ Branches 6 and 9 available for study, personnel in the passive air defense services totalled as follows:

Status 15 February 1945

Uniformed personnel	35 600
Auxiliary personnel	23 900
Total	59 500

Status 1 April 1945

Uniformed personnel	30 000
Auxiliary personnel	18 500
Total	48 500

420. For more details on the Passive Air Defense Services see Karlsruhe Document Collection: Die LS-Abteilungen (mot.) der Luftwaffe im 2. Weltkrieg, by Hans Woerringen, 1956, which deals primarily with the passive air defense regiments and motorized battalions.
421. See III, g, 1, above.

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307 a. Motorized Passive Air Defense Battalions.

1. Organization and Equipment. Activation of the Motorized Passive Air Defense Units.

The initiating step was the incorporation into the Air Force of the Safety and Auxiliary Motorized Battalions, redesignated as Passive Air Defense Motorized Battalions. These units already were awarded first priority in the allocation of spaces in military billets, and received their operational orders from the air district command in whose area they happened to be stationed. Their other logistical and personnel requirements were handled by the local police authorities in the garrison town. These dual channels of command control on the one hand and logistical supply responsibilities on the
308 other, plus the unclear disciplinary conditions within the battalions, in the long run produced intolerable circumstances, which was particularly complicated because the Safety and Auxiliary Battalions consisted of members of the security police forces, of the firefighting forces, and of the ~~XXXXXXXXX~~ ~~XXXXXXXXXX~~ Safety and Auxiliary Service.

This was the reason for transfer of the battalions to the Air Force in 1942. The final step in this transfer was that the officer personnel in the battalions were taken into the officer corps of the Air Force in March 1942.

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308 Because of the heterogeneous personnel in the officer corps of the motorized safety and auxiliary battalions, the Air Force Personnel Office had to establish special procedures for this purpose.[422] All officers in the battalions (including medical officers) who were from the security police, and all other officers from the pre-World War I military forces (after an investigation of their non-military suitability) were taken into the Air Force Officer Corps en bloc as "Special Passive Air Defense Officers for the Duration of the War." As long as he remained assigned under the Reich Minister for Aviation and Commander in Chief of the Air Force, each officer was awarded an established rank. The rank designation was followed by the letters "LS" (Luftschutz--Passive Air Defense) in parentheses. ~~xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx~~

Special arrangements and regulations also became necessary for the training of future officer personnel within the battalions. All battalion personnel considered suitable and recommended for assignment in officer grades were detailed for service in an air training regiment, where they received military training. After this training such personnel could

422. Karlsruhe Document Collection: Erlass R.d.L. u. Ob.d.L.-Luftwaffenpersonalamt - Az. 11b Nr. 946/42 g.Kdos. (31) betr. Organisation des Luftschutzes vom 31. 3. 1942.

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309 be awarded the rank of 2d Lieutenant (Passive Air Defense) on recommendation by the appropriate air district command. For all other purposes promotion was subject to the regulations applicable to officers in recalled status (Offizier zur Verfuegung).

As taken over from the Safety and Auxiliary Service, the motorized passive air defense battalions were organized as follows:

Battalion Headquarters Staff

1st (Fire-Fighting and Decontamination) Company
2d " " " " "
3d (Repair) Company.

The authorized battalion strength in commissioned officers, noncommissioned officers, and men at the time was 579, and each battalion had the following vehicles:

12 fire engines, Type 25
6 trailer-mounted power pumps
4 decontamination trucks
2 decontamination equipment trucks
4 power operated ladders
4 hose trucks
8 repair personnel carriers
1 bomb removal truck
1 air-compressor truck
1 tools and accessory truck
6 ambulance trucks
3 medical equipment trucks

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309 1 telephone construction truck
1 signal car
3 fuel tanker trucks
310 5 truck-mounted field kitchens
5 truck-mounted offices, etc. (Wirtschafts-LKW)
1 office-supplies truck
1 repair-shop truck
1 artisan personnel truck
3 reserve trucks
20 motorcycles, 8 of them with sidecar
20 cars
127 motor vehicles in total.

Travelling at a speed of 24 miles, and with its vehicles spaced accordingly, a motorized passive air defense battalion took up alomst 4 miles of road space.

All vehicles were of the latest models, and as air warfare became increasingly intensified everything possible was done to improve all equipment and adapt it in the light of the latest experience. Thus, the battalions received sound locating instruments to expedite the finding of persons buried alive, and radio equipment to insure secure transmittal of orders and other information.

The following data is offered to illustrate the performance capacities of some items of heavy equipment:

Fire Engine Type RS 25. This was a fire engine intended for large scale operations, and which met all standards of requirement. It had a 110 hp engine which, besides driving

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311 the truck provided the power for operation of the pump. The pump had fittings for two type A suction hoses and for six type B pressure hoses. Maximum peformance was 2 500 liters per minute, which was the reason for the identification of the pump as KS 25. The pump was also fitted to eject a foam spray, and each fireengine carried along 220 pounds (100 kilogram) of foam chemicals which could produce 100 cubic meters of foam.

Fire Engine Type KzS 8. This was far more maneuverable vehicle, with a pumpfing capacity of 800 liters per minute, which was not as restricted to roads for movement.

Hose Trucks. These carried large supplies of hoses, each having approximately 1 800 meters of Types B and C pressure hoses besides reserve suction hoses.

Power Ladders Type KL 2 6. The ladders were oil-pressure operated, the pressure used being 70 pounds per square inch (5 atmosphaer). Each such ladder could be extended to a total length of 31 meters.

Repair Trucks. These carried along all light and heavy items of equipment which might be needed in fire control or other major damage control operations. This included blasting equipment, chain and other pulley blocks, tripods, acetylene cutters, electricity generator units, power saws, drilling machinery, sledge hammers (Boschhaemmer), and innumerable other minor items.

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311 According to the new tables of organization established in 1942, each motorized passive air defense battalion was authorized the following personnel and vehicles:

37 officers (including medical officers)
1 administrative inspector
82 noncommissioned officers
489 enlisted men
42 passenger cars
22 trucks
73 special type technical vehicles
5 field kitchens
24 motorcycles

making a total of 609 personnel and 169 vehicles.

312 Equipment catalogs and loading schedules were establsihed for power pumps, hose trucks, power ladders, personnel carriers, vehicles of the repair services, workshop trucks, and decontamination equipment trucks, and were published as Air Force Field Manual L. Dv. 783, with annexes 1-15.[423]

Initially no provisions were made to arm personnel of motorized safety and auxiliary battalions, but the need to do so became evident during their first commitment in the zone of military operations. From then on these battalions had small arms and machine guns, and were thus armed in a manner similar to units of the Air Force ground organization.

The continuously repeated recommendation to provide the

423. Appendix A.

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312 battalions with light antiaircraft guns produced no results, although serious losses were incurred frequently in personnel and materiel when the battalions came under low level air attacks.[424]

The missions which developed for the battalions in their assigned areas were exceptionally diversified.[425] Personnel were subjected to exceedingly difficult conditions of action. After their approach route, which was usually long, personnel had to go into action immediately for long periods without interruption under conditions of smoke, steam, and excessive heat. This was not only the case in firefighting operations, but also in action to rescue persons buried alive or to evacuate the inmates of air raid shelters from areas threatened by large area fires. Exposed continuously not only to the hazards of air attack, but also to those of delayed action bombs, of poisonous gases and fluids emanating from burning chemical products, and to the psychological impact of the frequently horrible appearance of men, women, and children who had been killed, each man, usually unknown and unnamed, battled to accomplish the mission of rescuing and/or preserving human life and property. Numerous losses were incurred, but unfortunately

424. See also Die LS-Abteilungen (mot.) der Luftwaffe im 2. Weltkrieg, Hans Worringen, 1956.
425. Karlsruhe Document Collection: Der Kampf der LS-Verbaende im Schadensgebiet, Hans Worringen, 1956.

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313 there is no possibility to enumerate them in detail.

Great demands were also made on the commissioned and non-commissioned personnel in the battalions. Great difficulties were encountered already in the transmission of orders, in the proper assignment of units in city areas covered with debris and clouds of smoke, and in the maintenance of cooperation with adjacent passive air defense battalions. The necessity to be able to cope with quickly changing situations called for a marked ability to size up a situation quickly and to make quick decisions. It is no simple matter to "wheel about" a passive air defense unit in action with enormous lengths of hose unwound and in use. Furthermore, the matter of supplying units committed in large damage control areas as a rule presented very serious problems.

The types of vehicles and items of equipment in use in the battalions were developed by the appropriate specialized departments in the Office of the Reich Minister for Aviation and Commander in Chief of the Air Force, and were modified and improved constantly in line with the latest experience. One piece of equipment which proved of particular significance was the Type 15 Firefighter-Tanker Truck. Able to operate independently of outside water supplies, this fire engine could be used in quick action to localize numerous small fires

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313 and thus prevent their spreading to develop into large area fires. In the future it would appear wise to assign passive air defense units larger numbers of these fire engines than was the case in World War II.

The German passive air defense forces were not adequately equipped with radio. Speedy action and the prevention of any delays at the pilot stations are the essential conditions for success. Because of the terrific speed at which fires sometimes spread, every minute counts. The possibility must be taken into account that wire communications might be interrupted at any time. The use of aircraft for the direction of passive air defense operations will be dealt with later in this study.[426]

Under the German system the resupply of special type vehicles and other equipment for passive air defense was handled through the Air Force equipment depots.[427]

Developments in the air situation crated the necessity for the motorized passive air defense battalions to change their stations frequently, and this also involved changes in the chain of command. Command control over any one of the battalions could change at any moment from one passive air defense regiment to another, or a battalion could be committed in

426. ~~XXXXXXXXXXXXX~~ See III, c, 2, above.
427. See VII, below.

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314 independent action.

Each battalion was stationed in proximity to some defense target, and was required to familiarize itself thorourhly with the specific features of structure and layout of that target, so that it could take immediate action in the event of an air attack. In other cases the battalion received its operational orders from the appropriate air district command headquarters.

In the matter of the organization and equipment of a passive air defense battalion (motorized) widely varying recommendations for improvement were submitted on the basis of operational experience.[428]

One recommendation was that the assignement of a special repair company (the 3d Company) should be discontinued, and that each of the battalion's three companies should be uniformly equipped with firefighting, repair, and rescue and salvage items. In other cases retention of the organization as it existed is recommended with certain modifications of a technical-organizational nature, while yet other recommendations suggested that units of the motorized passive air defense forces should be organized on the same pattern as units of the firefighting police. The latter recommendation, if adopted,

428. Karlsruhe Document Collection: Luftschutzfürsorge, Oberleutnant Sulzbach, Footnote 114; also Die Luftschutz-Brigade Nr. 1, by Generalmajor Teschner in Ziviler Luftschutz, Volume 1/1956, Verlag Gasschutz und Luftschutz, Koblenz, a photostat copy of which is included with this study as Appendix 15.

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314 would have insured uniformity in the organization of the units of these two forces, which are usually employed simultaneously, and uniform unit effectiveness, which would have simplified command control.

315 The idea of conforming to the pattern of the firefighting police in any future organization of passive air defense units is sound. However, it would be necessary to establish from the outset the extent to which the fire fighting police forces could cope with the missions of rescuing buried persons and of carrying out temporary repairs in addition to their other functions, a problem which exceeds the scope of this study.

Although it appears unlikely that chemical weapons will be used in the future, it nevertheless appears necessary to maintain a decontamination service, although on a reduced scale, within the mobile passive air defense units. The existence of personnel with training in this subject and equipped with the necessary protective clothing proved extremely valuable in damage control action in chemical works, oil works, and in operations to salvage dangerous chemicals.

A medical service is definitely essential, but opinions vary on its scope. One point is clear, namely, that in addition to taking care of unit personnel, the service must be

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315 able to aid members of the civilian population in a stricken area while the units is in action there.

It is recommended generally that motorized passive air defense battalions should have more special type vehicles and specialized items of equipment. Thus, as early as after the first large scale attacks against Hamburg in 1943, the demand was raised for increased equipment with Type TLF 15 Tanker-Fire Engines,[430] and for armored caterpillar rescue vehicles.

316 The development of special type vehicles will play an important role in the future. On the one hand it will be necessary to transport the necessary servicing personnel on their equipment vehicles, in preference to moving them up in special personnel carriers; on the other hand the vehicles must at least to some extent be capable of all-terrain travel. It is to be assumed that the problem of debris-blocked roads, which cannot be cleared with the necessary speed, will assume larger proportions than in the past.

In addition to the above, each sizable units must have heavy road clearing machinery capable of ploughing an emergency route over or through mounds of rubble and debris. It would be impossible to allocate firefighting units with a full sufficiency of hoses and quick coupling pipes. Under the German system each motorized passive air defense battalion had

429. Footnote 306, above.
430. Footnote 441, below.

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316 approximately 3 300 yards (3 kilometers) of quick-coupling pipes. Planning for operations by mobile passive air defense units must be based on the ability to operate on independent water supplies.

Very special importance attached and still attaches to the equipment of passive air defense units with foam fire extinguishing equipment. Particularly in action against oil fires wide experience was gained and considerable success was achieved with such equipment.[431]

Under the German system it was customary to consolidate a number of motorized passive air defense battalions within an air district command area under a passive air defense regiment headquarters. Besides directing and controlling the operations of their battalions, the regimental commanders were responsible for such matters as troop discipline and administration. Great difficulties were encountered in the field of the administrative and disciplinary control of the units, which were assigned directly under the air district commands and frequently had to change their stations, including movements into outside air districts, as the current air situation

317 required. The appropriate staff sections (Gruppenleiter Ia op 3) of the air district commands did their utmost to maintain and improve the effectiveness of their motorized passive

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317 air defense battalions. Having no service command authority, however, they were not always able to put their desires and recommendations into effect, so that deficiencies became apparent, particularly when battalions were transferred to other air district commands, and even more so when units were dispatched to operate in the zones of army operations in the eastern theater.[432] Recommendations to establish special passive air defense staff sections (Hoehere LS-Fuehrer) at air fleet headquarters, and passive air defense sections (LS-Fuehrer) at air district commands, following the pattern of the Air Signal Corps, produced no results.

In all cases where passive air defense regiment headquarters were established, the regimental commanders were able to take action in the fields of service control and discipline, which improved the effectiveness of their units.

For more information on organization and chains of command in the motorized passive air defense forces the reader is referred to the next section of the present study.

A passive air defense brigade headquarters was established in only one case, in Rumania. More details on this brigade will be found on page 441, below, and more details on its activities and performances in Chapter III, f, above.[433]

432. III, d, above.
433. See III, f, above.

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317 In addition to all other controls, the Inspector of Passive Air Defense Forces, within the Passive Air Defense Operations Staff at the Air Force High Command, had the mission of visiting and inspecting the various units regularly, and was responsible for the uniform control and equipment. On the basis of his reports the Reich Minister for Aviation and Commander in Chief of the Air Force could take action to remedy defects which became apparent.

2. Units of the Passive Air Defense Forces (Motorized).[434] At the beginning of the war only a small number of safety and auxiliary service motorized battalions were in existence. Even before incorporation of the service with the air force, the number of battalions was increased. Further activations after transfer to the Air Force brought the total up to

1 Passive air defense brigade
8 Passive air defense regimental headquarters
48 Motorized passive air defense battalions
2 passive air defense replacement battalions
1 passive air defense school
1 passive air defense instruction company (at the Reich Institute of the Air Force for Passive Air Defense).

The following is a brief survey of the status of the above units:

1st Passive Air Defense Brigade, Headquarters: Ploesti, Rumania

5th Passive Air Defense Regiment

434. See Woerringen for more details on the individual units and important operations.

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318 1st Passive Air Defense Brigade--Continued:

8th Passive Air Defense Regiment

Passive Air Defense Bomb Disposal Detachment

1st Firefighting Police Regiment (tactically assigned)

One smoke battalion

One special purposes passive air defense battalion.

1st Passive Air Defense Regiment, Headquarters: Baer.

Five passive air defense battalions (14th, 19th, 22d, 23d, 25th, 26th, and 27th).

2d Passive Air Defense Regiment, Headquarters Hamburg-Blankenese.

A number of frequently changing motorized passive air defense battalions. A report submitted by the officer commanding the regiment at the time and dealing with operations on the occasion of the large-scale attacks against Hamburg typifies the command control activities by the regimental headquarters.[435]

3d Passive Air Defense Regiment, Headquarters Berlin--transferred in February 1945 to Ludwigsburg/Mecklenburg.

A very frequently changing number of motorized passive air defense battalions.

4th Passive Air Defense Regiment, Headquarters: Etampes near Paris, transferred in August 1944 to Merseburg and later to Burg Saaleck.

A frequently changing number of motorized passive air defense battalions.

5th Passive Air Defense Regiment, Headquarters: Ploesti, Rumania.

27th Passive Air Defense Battalion

30th " " " "

435. Footnote 441, below.

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319 5th Passive Air Defense Regiment--Continued:

41st Passive Air Defense Battalion.

6th Passive Air Defense Regiment, Headquarters in 1942 in Operational Zones of the Eastern Theater; from 5 June 1943 at Darmstadt.

Status 1942 :

16th Motorized Passive Air Defense Battalion
42d " " " " "

Status after June 1943:

25th Passive Air Defense Battalion
33d " " " "
37th " " " "
22d " " " "
49th " " " "

7th Passive Air Defense Regiment, Headquarters: Munich up to Autumn 1944, then Neulengbach near Vienna.

Status prior to autumn 1944:

26th Passive Air Defense Battalion (Motorized)
38th " " " " "
44th " " " " "

Later status:

17th Motorized Passive Air Defense Battalion
36th " " " " "
43d " " " " "

8th Passive Air Defense Regiment, Headquarters: Campina, Rumania; transferred in October 1944 to Heydebreck, Upper Silesia.

Status in Rumania:

45th Passive Air Defense Battalion (Motorized)
46th " " " " "
47th " " " " "

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319 1st Passive Air Defense Replacement Battalion, Headquarters: Wurzen.

2d Passive Air Defense replacement Battalion, Headquarters: Bonn-Venusberg; transferred in September 1944 to Wurzen.

Passive Air Defense School, Garrison: Wurzen; transferred in September 1943 to Bonn-Venusberg and in September 1944 to Wurzen.

11th Motorized Passive Air Defense Battalion (Organic to 2d Passive Air Defense Regiment).

Activated at Stettin in January 1940

Garrison: Stettin; transferred to Magdeburg in May 1940, and to Varel in October 1940.

12th Passive Air Defense Battalion (from 1942 on under 2d Passive Air Defense Regiment).

Activated at Berlin in January 1940

Garrison: Berlin; transferred in June 1942 to Bremen-Vegesack.

13th Passive Air Defense Battalion (Motorized),(Organic to 3d Passive Air Defense Regiment).

Activated at Merseburg in late 1939;

Garrison: Merseburg; transferred in January 1943 to Halle, in January 1945 to Berlin-Spandau.

14th Motorized Passive Air Defense Battalion, under 5th, later 1st Passive Air Regiment.

Activated at Leipzig in late 1939

Garrison: Muenster; transferred in autumn 1943 to Essen-Kray, later to Osnabrueck.

15th Motorized Passive Air Defense Battalion.

Activated at Jena in December 1939

Garrison: Jena; transferred to western theater in May 1940; committed as a combat force from 1944 on.

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320 16th Motorized Passive Air Defense Battalion (under 3d Special Purposes and later 3d Passive Air Defense Regiment).

Activated at Koenigsberg, Eastern Prussia, in 1940.

Garrison: Koenigsberg; later at Maikop in Russia and Oschatz in Saxony.

17th Passive Air Defense Battalion (Motorized), (under 1st, later 7th Passive Air Defense Regiment).

Activated at Dortmund in 1940.

Garrison: Dortmund, later Zistersdorf in Austria.

18th Motorized Passive Air Defense Battalion, (successively under 1st, 3d, 1st, 6th Passive Air Defense Regiments).

Activated at Bonn.

Garrison: Cologne; transferred to Berlin in November 1943, back to Cologne in April 1944, to Offenburg/Baden in July 1944.

19th Passive Air Defense Battalion (Motorized), (under 1st Passive Air Defense Regiment).

Activated at Bonn-Hangelar in 1942.

Garrison: Muehlheim/Ruhr Region up to January 1943.

20th Motorized Passive Air Defense Battalion.

Garrison: Essen-Kray; transferred in August 1943 to Muenster.

21st Motorized Passive Air Defense Battalion, (under 2d Passive Air Defense Regiment)

Activated at Hamburg in 1941.

Garrison: Hamburg-Wentorf.

22d Motorized Passive Air Defense Battalion, (under 1st Passive Air Defense Regiment).

Activated at Muenster in later 1939.

Garrison: Muenster; transferred to Nuremburg-Zirndorf in April 1942.

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321 23d Motorized Passive Air Defense Battalion, (under 1st Passive Air Defense Regiment, later under Air District Command Belgium-Northern France, later reverted to 1st Regiment)

Activated at Dortmund in late 1939.

Garrison: Successively at Dortmund; Unna; Schwerin; Western Theater, up to 1943, then successively at Dorsten, Gelsenkirchen, Essen, and Herbede.

24th Motorized Passive Air Defense Battalion, (under 1st Passive Air Defense Regiment).

Activated at Lenkerbeck, Ruhr Region, in 1940.

Garrison: Dortmund-Marten.

25th Motorized Passive Air Defense Battalion (under 1st, later 5th Passive Air Defense Regiment).

Activated at Essen in 1939.

Garrison: Successively at Essen, Mannheim-Kaefertal, Weinheim/Bergstrasse, and Holzkirchen bei Munichen 436

322 26th Motorized Passive Air Defense Battalion, (under 1st, later 5th Passive Air Defense Regiment).

Activated at Duesseldorf in 1939.

Garrison: Successively at Hilden bei Duesseldorf, Cassel, and Munich.

27th Motorized Passive Air Defense Battalion, (under 1st, later 5th Passive Air Defense Regiment).

Activated at Cologne in 1939.

Garrison: Successively at Cologne, Cassel, Ploesti/Rumania(there from 1943 till defenses collapsed in 1944).

29th Motorized Passive Air Defense Battalion.

Activated at Marke bei Jever, Oldenburg, in 1942.

Under	Stationed at
2d Passive Air Defense Regiment	Wismar
1st " " " "	Essen-Kray

436. Unfortunately no records have been uncovered on motorized passive air defense battalions missing in the above tabulation.

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322 29th Motorized Passive Air Defense Battalion--Continued

Under	Stationed at
2d Passive Air Defense Regiment	Greifswald
3d " " " "	Berlin-Gatow
1st " " " "	Dortmund, later Cassel
2d " " " "	Stettin
3d " " " "	Berlin-Doeberitz
1st " " " "	Dortmund

30th Motorized Passive Air Defense Battalion.

Activated at Dresden early in 1941.

Garrison: Dresden up to 1941. Then under 5th Passive Air Defense Regiment at Campina, Rumania.

31st Motorized Passive Air Defense Battalion.

Activated at Frankfurt on Main in 1940.

Garrison: In western theater under Air District Command Belgium-Northern France; then at Nuremburg under 6th Passive Air Defense Regiment.

32d Motorized Passive Air Defense Battalion.

Garrison: Darmstadt under Air District Command XII; then in Western theater under Air District Command Western France; later at Hanover under 2d Passive Air Defense Regiment.

33d Motorized Passive Air Defense Battalion.

Activated at Bensheim/Bergstrasse in 1939.

Garrison: Western Theater under Air District Command Western France; transferred to Darmstadt in 1941 under 6th Passive Air Defense Regiment; then to Eastern Theater (Hungary and later Upper Silesia).

34th Motorized Passive Air Defense Battalion.

Activated at Nuremburg in 1940.

Garrison: Nuremburg until May 1940 under Air District Command VII; then in Western Theater under Air District Command Paris, later 4th Passive Air defense Regiment;

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323 34th Motorized Passive Air Defense Battalion--Continued:

finally at Berlin from 1943-45 under 3d Passive Air Defense Regiment.

35th Motorized Passive Air Defense Battalion.[437]

36th Motorized Passive Air Defense Battalion.

Activated at Munich in 1939-40.

Garrison: Kaiserslautern up to April 1940 under Air District Command VII; in Western Theater up to January 1941 under Air District Command Western France; at Ploesti/ Rumania under 5th Passive Air Defense Regiment until defenses collapsed there.

37th Motorized Passive Air Defense Battalion.

Activated at Kaiserslautern in 1941.

Garrison: Kaiserslautern, later Forbach, under 6th Passive Air Defense Regiment.

38th Motorized Passive Air Defense Battalion.

Activated at Augsburg in 1942.

Garrison: Augsburg-Gattlingen under 7th Passive Air defense Regiment.

39th Motorized Passive Air Defense Battalion.

Activated at Guetersloh in 1941.

Garrison: Guetersloh under 1st Passive Air Defense Regiment.

40th Motorized Passive Air Defense Battalion.

Activated at Berlin in 1942.

Garrison: Berlin-Bernau under 3d Passive Air Defense Regiment.

41st Motorized Passive Air Defense Battalion.

Activated at Vienna in 1940.

Garrison: Konstanza, Black Sea, under 5th Passive Air defense Regiment; then under Air District Command I

437

437. It has not been possible to uncover records giving the information missing in the above tabulation.

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323 41st Motorized Passive Air Defense Battalion--Continued: temporarily at Praust bei Danzig for rehabilitation; finally from early 1943 on at Paulesti near Ploesti/Rumania.

324 42d Motorized Passive Air Defense Battalion.

Activated at Vienna in 1940.

Garrison: Vienna under Air District Command VII; transferred to Ploesti/Rumania under 5th Passive Air Defense Regiment in spring 1941; to Russian theater under Special Purposes Pas. Air Def. Regiment in March 1942; to Pruetzke, near Brandenburg, in April 1943, under 3d Passive Air Defense Regiment.

43d Motorized Passive Air Defense Battalion[438]

44th Motorized Passive Air Defense Battalion.

Activated at Ingolstadt in 1943.

Garrison: Rain on Lech, near Ingolstadt under 7th and from 1944 on under 6th Passive Air Defense Regiment.

45th Motorized Passive Air Defense Battalion.

Activated at Moreni/Rumania in 1944.

Garrison: Moreni, near Ploesti under 8th Passive Air Defense Regiment.

46th Motorized Passive Air Defense Battalion.

Activated at Campina/Rumania in 1944.

Garrison: Campina under 8th Passive Air Defense Regiment.

47th Motorized Passive Air Defense Battalion.

Activated at Konstanza/Rumania in 1944.

Garrison: Konstanza under 8th Passive Air Defense Regiment.

48th Motorized Passive Air Defense Battalion.

Activated at Dessau in 1943.

Garrison: Magdeburg under 3d Passive Air Defense Regiment; from August 1944 to February 1945 under 4th Passive Air Defense Regiment.

~~49th~~
438. See Footnote 437, above.

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324 49th Motorized Passive Air Defense Battalion.

Activated at Vienna in 1944.

Garrison: Saarbruecken under 6th Passive Air Defense Regiment.

50th and 51st Motorized Passive Air Defense Battalions.[439]

52d Motorized Passive Air Defense Battalion.

Activated at Duisburg in 1944.

Garrison: Successively at Duisburg under 1st, and Kattowitz (Katowice) under 8th Passive Air Defense Regiment; Breslau under Fortress Commander.

53d Motorized Passive Air Defense Battalion.

Activated at Hamburg in 1944.

Garrison: Bruex, Czechoslovakia, under Air District Command VIII.

55th Motorized Passive Air Defense Battalion.

Activated at Dortmund in 1944.

Garrison: Dortmund under 1st Passive Air Defense Regiment.

58th Motorized Passive Air Defense Battalion.

Activated at Aschersleben in 1944.

Garrison: Aschersleben under 3d Passive Air Defense Regiment.

A brief review of the numerous and usually exceedingly difficult missions of the above battalions, and of their performances, experience, and ultimate fate, insofar as such information is available, will be found in the previously mentioned appendix Die LS-Abteilungen (mot.) der Luftwaffe im

439. See Footnote 437.

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325 2. WeltKrieg, by Hans Woerringen.[440]

A detailed description of the operations of the 2d Passive Air Defense Regiment during the large-scale attacks against Hamburg will be found in a report submitted by the officer commanding the regiment at that time and dated 17 August 1943.[441] The report includes an analysis of the experience gained and recommendations for improvement, and can be considered as a typical example of such reports, and as an example of the command and operations of passive air defense regiments in general.

3. The Commitment of Passive Air Defense Forces outside of the Zone of Interior.[442]

aa. In the Western Theater.[443] At the beginning of the 1940 campaign in the west, the units later known as motorized passive air defense battalions were still designated motorized security and auxiliary services battalions. Five such battalions followed up in the immediate rear of the fighting forces to execute special missions.[444] After the campaign was over these battalions for the time being remained in the occupied western territories. The following units were involved:

440. See Footnote 420, above.
441. Karlsruhe Document Collection: "Terrorangriffe auf das Stadtgebiet Hamburg in der Zeit von 25.7.-3.8.1943", report by 2d Passive Air Defense Regiment dated 17 Aug 43.
442. More details will be found in Appendix 28: "Einsatz der-
Continued.

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325 The 15th Motorized Safety and Auxiliary Services Battalion, activated at Jena, was assigned under Air District Command Belgium-Northern France. With headquarters at Meysse, near Brussels, its mission was to protect the coastal areas along the English Channel from Antwerp to Rouen.

The 32d Safety and Auxiliary Services Battalion (Motorized activated at Mainz was assigned under Air District Command Western France. With headquarters at Rennes, its mission was to protect the areas of Normandy, certain areas of Brittany, and the coastal areas as far as the mouth of the Loire River.

The 33d Motorized-Safety and Auxiliary Services Battalion, activated at Mannheim, was assigned the adjacent coastal area, extending from St. Nazaire to the mouth of the Gironde River, with headquarters at St. Florent le Viel.

The 36th Motorized Safety and Auxiliary Services Battalion activated at Karlsruhe, was assigned responsibility for the rest of the coastal area from the mouth of the Gironde River to the Spanish frontier, with headquarters at Bordeaux.

The 34th Motorized Safety and Auxiliary Services Battalion activated at Nuremburg, was assigned initially to the air Fleet reserve and stationed at Charenton, near Paris. However, the air situation at the coast soon necessitated its transfer.

442--Continued: Luftschutzverbaende im 2. WeltKrieg im Operationsgebiet," by Major Hans Worringen, 1956
443. See Appendix 28, pp. 1 ff., and picture series.
444. For details on missions and performances see also III, d, above.

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326 Its 1st Company was dispatched to Brest, its 2d to Lorient, and its 3d to Cherbourg.

Even as early as in 1940, the demands made on all of the above units were exceedingly severe, and in selfless devotion to duty all commissioned and noncommissioned officers and men did their utmost to meet these demands. The battalions were assigned under the several air district commands and maintained close contact with the military government area headquarters of their respective areas. Each of these headquarters had a special ~~xxxxxxxxxxxxxxxx~~ civilian air defense liaison officer on its staff.[445] Concurrently with their operational missions, the battalion commanders had instructions to supervise the precautionary passive air defense measures taken within their protective areas.

The air situation quietened considerably at the end of 1940, and already at the beginning of 1941 the first Safety and Auxiliary Services Battalions were transferred back to the Zone of Interior. The last to return was the 34th, meanwhile redesignated as the 34th Motorized Passive Air Defense Battalion, which was reassigned in the Berlin area.

bb. In Rumania.[446] The first motorized passive air

445. See III, e, above, and Appendix 15: Report by Major Teschner.
446. See III, f, above, and Appendix 28, pp. 8 ff.

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327 units assigned to protect the oil fields and oil refineries in the Ploesti area were dispatched to Rumania late in 1941.

The 42d Motorized Passive Air Defense Battalion, activated at Vienna, initially assumed responsibility for the oil producing and processing works around Ploesti. Because of the urgent need for additional forces, a regimental headquarters, the 5th Passive Air Defense Regiment, was activated at headquarters of the 1st Passive Air defense Replacement Battalion, Wurzen, and dispatched to Rumania, together with the following units; under its control:

30th Motorized Passive Air Defense Battalion, with headquarters at Campina;

27th Motorized Passive Air Defense Battalion, with headquarters at Ploesti;

41st Motorized Passive Air Defense Battalion, with headquarters at Paulesti, north of Ploesti;

42d Motorized Passive Air Defense Battalion, with headquarters at Ploesti.

Further reinforcements became necessary after the US Air Forces commenced penetrating to the oil regions of Rumania. In order to insure uniform damage control action a brigade headquarters, the 1st Passive Air Defense Brigade, was established in Ploesti in 1943 and given tactical control over all passive air defense forces in the country, including the Rumanian fire fighting forces. Another passive air defense regiment was

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327 activated at the same time, namely, the 8th Special Purposes Passive Air Defense Regiment, with headquarters at Campina. This regiment in March 1944 controlled three motorized passive air defense battalions; the 45th, with headquarters at Moreni; the 46th, with headquarters at Campina; and the 47th, with headquarters at Konstanza.

328 However, these three battalions were not fully effective: each of them contained one German cadre company, while its other two companies were made up of untrained Rumanian personnel.

Unfortunately, approval was not granted to the recommendations to return all passive air defense units, which were not suitable for ground combat missions, to the Zone of Interior in time for more important missions. The majority of the units were therefore captured. Only the headquarters staff of the 8th Special Purposes Passive Air Defense regiment, together with one of the regiment's cadre companies, and small elements from some of the battalions succeeded in escaping envelopment and reestablishing contact with the withdrawing German front.

447

cc. In Russia. Headquarters, 3d Special Purposes Passive Air Defense Regiment was activated in 1942 for the express purpose of protecting oil regions in territories it was

447. For more details see Appendix 28, pp. 13 ff.

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328 hoped German ground forces would occupy. For this mission the regiment received the 16th Motorized Passive Air Defense Battalion, from Koenigstein; and the 42d Motorized Passive Air Defense Battalion, from Vienna and currently deployed in Rumania.

The regiment was assigned under Air District Command Dnepropetrovsk, and was under tactical control by the Mineral Oil Brigade (Brigade Mineraloel). In addition to the normal missions of all passive air defense units following the advancing Army forces, the regiment had the specific mission of restoring to operability the oil pumping stations and oil storage installations along the oil pipelines leading from Baku and Batum.

329 After the German advance came to a halt in the summer of 1942, the regiment's two battalions remained at Maikop and Krasnodar, respectively, each of them releasing one company for the activation of a new units, Motorized Passive Air Defense Battalion Pyatigorsk, which assumed responsibility for the protection of five separate stations.

To enable them to cope with their manifold duties, all passive air defense units were reinforced by Russian personnel. Recruited partly from prisoners of war and partly from volunteer civilians, these supplementary personnel rendered excellent services.

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329 Unfortunately, the units were not appropriately equipped to cope with the specific conditions encountered in the Eastern Theater; this applies to the lack of standardization in the vehicles assigned and, what was particularly fateful, to the lack of the essential weapons. It would be beside the point to examine in this study the question of who was responsible for these deficiencies. Another serious factor was the fact that developments in the tactical situation made it necessary to organize the personnel, most of whom were at an advanced age, into replacement companies and employ them in ground combat, in which they nevertheless gave a good account of themselves.

During the German withdrawals in December 1942, Passive Air Defense Battalion Pyatigorsk was successfully evacuated in time. The 16th and 42d Battalions succeeded in reaching Rostov , some of their units crossing the ice covered Sea of Asov to its northern shores, although they did lose some of their heavy vehicles, which broke through the ice.

Experience in these operations made it clearly obvious that passive air defense units intended for employment in operational zones or in any insecure areas definitely must be able to meet all requirements of combat, both in respect to their equipment with weapons and in respect to their combat training.

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330. 4. The Training of Motorized Passive Air Defense Troops. Whereas noncommissioned officer and other enlisted personnel could receive functional training, with the exception of special courses, within the units, new ways and means had to be found for the training of officer personnel. As mentioned previously, it was exceptionally difficult to obtain suitable officer replacements for the passive air defense arm. In addition to being a fully qualifoed leader of troops, the passive air defense officer within a relatively short time had to absorb a large measure of specialized technical knowledge. In addition he had to receive training in the special features of command and tactics in a hitherto completely foreign special service branch.

The 1st Passive Air Defense Replacement Battalion at Wurzen received instructions to establish a passive air defense school . The purpose here was to retrain officers transferred to the service from other branches of the Air Force or from the Army, and to familiarize them with the principles and tactics of firefighting, of salvage and rescue operations, and of damage control action in general.[448]

The school went into operation on 8 September 1942. Courses were conducted in a quick succession, and it was found that roughly 50 percent of the participants were able to qualify

448. Karlsruhe Document Collection: "Die Luftschutzschule fuer die Luftschutztruppen," by Hans Worringen, 1956.

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330 for assignment to the Passive Air Defense Army

Regulations were still lacking for training purposes, and these the Passive Air Defense School proceeded to compile in accordance with the needs revealed by practical experience, and to apply in future training.

A Training Company had been activated in the meantime with the special mission of improving the standards of infantry training within the passive air defense battalions in addition to specifically functional training. In the past, infantry training had been intentionally neglected, but now that it was to be assumed that battalions would be committed in the operational zones of the Eastern Theater, it became essential to place emphasis on training in this subject.

From then on continuing courses were conducted for company commanders and platoon leaders from the passive air defense motorized battalions, the object being to insure uniform application of the training regulations.

In the case of large-scale attacks against targets in the northern and central territories of Germany, the entire Passive Air Defense Replacement Battalion was frequently committed. As a rule the Training Company and the participants in current courses also participated in these operations.

Special mention is due here of the commitment of the

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331 Replacement Battalion during the large-scale attacks against Hamburg in July 1943, in which the battalion suffered heavy losses.

The steadily increasing severity of the air situation necessitated a considerable reinforcement of the passive air defense arm. The activation of new motorized passive air defense battalions, smoke battalions, and special purposes passive air battalions to operate dummy installations, led to creation of the 2d Passive Air Defense Replacement Battalion, with headquarters in the AAA Caserne at Bonn-Venusberg. The Passive Air Defense School was attached to this new battalion, where it had adequate space for its expanded training activities. The instructor staff was increased,[449] and the training programs were adapted currently to the latest experience.[450] Special courses were also conducted, for example, in the subjects of bomb disposal and decontamination.

When the German front in the west was forced back, the 2d Passive Air Defense Replacement Battalion was transferred rearward to Wurzen together with the Passive Air Defense School, a movement which took place between 17-23 September 1944. Systematic training activities ceased in February 1945.

The following regulations were applicable in the training of passive air defense forces:[451]

451. The following tabulation is not complete. It has not been possible prior to writing to establish the missing items.

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332 Air Force Field Manual L. Dv. #	Title
752	Training Regulations for Passive Air Defense Units (Ausbildungsvorschriften fuer Luftschutzeinheiten).
752/1	Training in the Firefighting Service (Ausbildung im Feuerloschdienst).
752/1a	Vehicles and Equipment (Fahrzeug- und Geraetekunde).
752/1b	Individual Training (Einzelausbildung).
752/3	Repair Service Training (Ausbildung im Instandsetzungsdienst).
752/3b	Construction, Supporting, and Reinforcing (Baukunde, Abstuetzen und Abteilen).
752/3c	Blasting and Bomb Disposal (Sprengen).
752/3d	Rubble Clearance and the Rescue of Buried Persons (Beseitigung von Truemmern und Bergen Verschuetteter).

449. See Footnote 448; Appendix 1.
450. See Footnote 448; Appendix 2.

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333 5. ~~Command Principles for Passive Air Defense Forces~~.

In passive air defense, organization and operational command are two distinctly separate missions. Whereas the organization involves long-range activities in which all pros and cons of a measures must be examined in cooperation with all interested agencies, operational command requires quick decisions and a complete mastery of the whole command apparatus.[452] As a rule the person responsible for the organization will not be identical with the person in operational command: the requirements in the two fields differ too widely, and in a certain sense can even be described as contradictory. During operations organizational activities recede into the background, the only decisive factors being a quick grasp of the current situation and the proper commitment of the available forces.

The command principles were worked out prior to the war in passive air defense field exercises, CP exercises, and map games, and it can be stated here that the principles formulated by the Office of the Commander in Chief of the Air Force/Passive Air Defense Operations Staff in Air Field Manual L. Dv. 751 represented a proper appraisal of coming developments. Taking these regulations as a starting point, principles governing the command of the passive air defense forces were developed. Initially, these principles were restricted

452. See highly interesting passages in "~~Fuehrung im Luftschutz~~", by Generalleutnant Haenschke, Bonn, in "~~Ziviler Luftschutz~~" Volume 2, February 1955.

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333 intentionally to the command of a motorized passive air defense battalion.[453]

The principles thus formulated in Air Field Manual L. Dv. 751/2 Command of a Passive Air Defense Battalion (Motorized)--~~Fuehrung einer Luftschutzabteilung (mot.)~~ for the first time establish clear definitions of the units known as motorized passive air defense battalions, outline their missions as a command reserve, and regulate the chains of command by which they were to be controlled in the Zone of Interior and other territories.

The manual then deals with the following subjects:

The transfer of a motorized passive air defense battalion; The specific features involved in the road motor movement or rail movement of a motorized passive air defense battalion.

Operations, with emphasis on the commitment of forces by the unit commander, the use of pilot stations, orientation by the unit command with a orientation team, the mission assignment--usually by the local apssive air defense chief and in exceptional cases assumption of on-the-spot tactical command by the unit commander in the damage control area, the issue of orders, cooperation, location of the command post and parking lots, the use of air spotters, specific damage control operations, and accelerated restoration to operability.

Billets and other premises.

Supplies.

453. Copy in Appendix 29. See also Karlsruhe Document Collection: L.Dv. 751/3"~~Taktische Leitlinien im Luftschutz~~."

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334 The principles thus established provided an outline for the conduct of operations by passive air defense regiments and independently operating battalions. If current developments in the air defense situation required, the appropriate officers in command of the air district commands issued supplementary or special regulation in addition. The following regulation issued by Air District Command VI is quoted as an example:

~~Commitment of Firefighting Forces~~.

At the Passive Air Defense pilot or guide stations the waiting time of units moving in from outside must be reduced to a minimum. Commissioned and noncommissioned officer personnel will be trained to take independent action. Particular care will be taken to insure that, during the unavoidable waiting period at pilot or assembly points, units will not remain inactive against developing fires until their operational orders arrive. With due consideration for the overall situation, unit commanders in such cases on their own decision will take quick and immediate action to commit firefighting teams. Requests by the population must not simply be rejected. If the unit's assigned mission excludes possibility to fulfill such requests the matter will be appropriately reported to higher echelons.[455]

454. See ~~XXXXXXXXXX~~ III, 5, above.
455. Excerpt from "~~Besondere Anordnung fuer den Luftschutz~~ Nr. 36" - Continued.

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335 The normal procedure would have been to first develop the principles governing the conduct of passive air defense operations and then build up the organization accordingly. In the past it proved possible to predict, with a relatively high degree of accuracy, coming developments in the air situation, although it was not always possible to translate appraisals into action in the organizational field with the necessary speed. As previously mentioned, the obstacles encountered were of an internal nature. The results were inescapable: the Passive Air Defense Branch, which had to have highly qualified personnel available, had to rely on personnel releases from other branches. These personnel were frequently unqualified, so that the whole service initially suffered from serious weaknesses and could only gradually be brought up to the necessary high standards of performance.

For the future it will be essential to establish speedily whether and in what scope military passive air defense units are to be activated to serve, in addition to the civilian passive air defense organization, more or less as passive air defense engineer units for special missions supplementary to the overall large-scale damage control operations. When employed at

455.--Continued: issued by Air District Command on 23 October 1943.

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335 damage control operations within military establishments or
336 military supply channels, such units would be under control by the appropriate military authorities. If employed in operations to protect the civilian population they should, as in the past, in the case of the passive air defense troops, be placed under the appropriate commanders of the civilian passive air defense system. The time of locally circumscribed commitments is a thing of the past in our age of atomic warfare. (It is essential to prevent growth of the idea that, as was the case with gas in World War II, atomic weapons will not be used in any future war).

Personnel in commands above the local level, and controlling areas approximating those of the former commanders of regular police, must be trained already during peace for their missions. This applies also to mobile passive air defense command staffs, such as those established and used successfully by some of the commanders of regular police.[456]

Along the lines described above steps should be taken to develop command principles for the direction of large-scale operations by combined units, and to test them in plans critiques and map exercises.

456. See appendix quoted in Footnote 452: "~~Fuehrung im Luftschutz~~," pp. 13 ff.

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338 b. ~~Passive Air Defense Smoke Battalions~~.[457]

1. ~~Organization~~. The following three types existed under the German system:

Motorized smoke battalions
Other mobile smoke units
Stationary smoke units.

Each of the two motorized smoke battalions in existence was organized in three companies of three 3-squad platoons. Insofar as tank cars or trucks were not available, the companies had the normal standard equipment, which consisted of smoke drums, each company having 54 smoke generators mounted on trucks, three to a truck. When necessary they could operate from their trucks.

Other mobile companies were partly motorized and were employed in accordance with the current air situation.

Stationary units were intended for permanent assignment to protect specific important targets. Their smoke generators were non-mobile and were placed in alternate positions to be operated in accordance with the current direction of the wind.

The total number of passive air defense smoke companies in existence was 98. Field manuals governing their operations were still in preparation when the war ended. In the meanwhile they operated in accordance with directives issued by the Reich Minister for Aviation and Commander in Chief of the Air

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337 Force/Passive Air Defense Operations Staff or Air Inspectorate 13. These directives also governed the training of personnel at the smoke screening school established within the 1st Passive Air Defense Replacement Battalion.

The personnel assigned by the military recruiting offices comprised only men from the oldest age classes subject to the draft, so that it became necessary towards the end of the war to make use of volunteers or auxiliaries conscripted under the law regulating the confiscation of property or services for defense purposes.

The companies had no established tables of organization prescribing an authorized personnel strength. In each case the number of smoke generators assigned, and thus also the number of personnel required, was determined by the size and extent of the target to be protected.

Although former trials had produced negative results, women were employed again from 1944 on to service, and in some cases to operate, stationary smoke generators. When provided with the necessary working and protective clothing these women gave satisfactory service.

2. ~~Smoke Generators~~. Besides captured tank cars or trucks two types of smoke-generating equipment were in use:

457. See VIII, d, 2, below, and Karlsruhe Document Collection: "~~Gliederung, Geraet und Einsaetze der LS-Neteltruppe~~," by Hans Worringen, 1956.

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338 The drum or barrel smoke generator.

This apparatus consisted of three major parts, namely,

The barrel gaid container, with roller hoops,

The compressed air cylinder, with accessories packed in protable "Pressure Gage Box."

The spray pipe, which emitted the smoke acid after it had been atomized in the atmmizer nozzle.

Smoke Generator Type NB 80/2. This apparatus had been developed by the Reich Institute of the Air Force for Passive Air defense with support from the smoke arm and the Smoke Screening School. It was a much more handy piece of equipment than the drum or barrel smoke generator, but was similar in operation. Depending on the atomizer nozzle used, the air pressure applied, and the quantity of acid in the container, the smoke produced had a duration of between 2 hours 40 minutes and 4 hours 40 minutes. It could be operated from any control point by electrical remote control, with groups of each 20 generators functioning simultaneously and as frequently as desired.

3. Operations. Normally, smoke companies were assigned tactically under the antiaircraft artillery commander responsible at the target involved. In such cases defensive antiaircraft artillery fire was the primary mission, and smoke screening activities had to be coordinated, in accord-

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338 accordance with current wind conditions, with the possibilities for effective antiaircraft fire.

In areas of concentrated smoke screening defense, smoke screening operations were the primary mission. Such areas had only light antiaircraft artillery units, tactically assigned under the local commander of smoke screening troops.

The 1st Motorized Passive Air Defense Smoke Battalion was first committed in Brest, France, and later at Ploesti, Rumania (see Footnote 457).

The first assignment of the 2d Motorized Passive Air Defense Battalion was in Norway. In the autumn of 1944 the battalion was redeployed in the Westwall area. Due to its high mobility and maneuverability, this battalion was able to cover all preparations for the Ardennes Offensive by smoke screening. The battalion also achieved success later in regrouping and troop unloading movements. Finally it was employed in the Magdeburg area and at the Bober River, Silesia.

The 98 other passive air defense smoke companies, some of them consolidated in battalions, were deployed in numerous and frequently changing missions. They were used primarily to protect the following categories of targets:

Coal hydrogenation plants
Chemical works
Other vitally important industrial works, particularly those producing commodities in short supply

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339 Installations of the electricity supply systems
Port and harbor areas
Ship building yards
Proving and research stations and installations
Traffic communication installations, such as
Canals
Railway bridges.

Preservation of the Brenner rail route, as the most important supply line for the German forces committed in Italy was due in some degree to the operations of the 8th Passive Air Defense Smoke Battalion. This battalion comprised three smoke companies, the 95th, 96th, and 97th. Right up to the end of the war it succeeded in accomplishing its mission of protecting the Brenner Pass rail route with its innumerable viaducts, in particular the bridge across the Etsch River Valley.

Examples of areas of concentrated smoke screening operations were the Auschwity and Dyhernfurth areas.

In the end the bottleneck in smoke producing acid supplies determined the scope and frequency of smoke screening operations, which towards the end of the war became increasinglz important.

c. ~~Special Purposes Passive Air Defense Battalions~~. As was the case with smoke screening operations, personnel from the Safety and Auxiliary Services (later Passive Air Defense Police) and from the Factory Air Defense System, plus Air Force construction units had to be used in the initial stages to operate

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340 dummy installations. When the construction and operation of dummy installations, and particularly large installations, assumed large proportions during the war and permanently assigned units became necessary for their operation, what were called "Special Purposes Passive Air Defense Companies" were activated for the purposes as part of the general passive air defense forces. These companies were assigned under the various air district commands and consisted of officers, noncommissioned officers and men who were only conditionally fit for military service. In air district command areas having a large number of important dummy installations, as was the case with Air District Command III,[458] these companies were consolidated to form Special Purposes Passive Air Defense Battalions.

Factory air defense personnel continued to service and operate small dummy installations of the various industrial concerns, but it was a basic policy to employ the new special companies to operate military dummy installations, for example dummy air fields, as well as the dummy installations at important armament factories and traffic centers, and large installations in general.

The air district commands allocated these forces by companies or in smaller elements to the various targets, where they were assigned under the antiaircraft artillery group or sub-group comman

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340 commander responsible for defense of the target or targets concerned, who had tactical and service control over them.

The missions of special purposes passive air defense units were of a highly diversified nature.[459] In addition to continued development of the existing dummy installations, they were responsible for the structural maintenance of the various installations constructed for the purpose of deceiving hostile airmen. Their activities here included lighting effects, camouflage to conceal the target, and the servicing and operation of contraptions to simulate the continued spreading of fires, for which purpose they also had to insure that adequate fuel supplies were maintained.

Action was taken under orders from the antiaircraft artillery commander on the basis of reports on enemy air penetrations. In cases where no antiaircraft units were assigned, the company or other unit commander himself was responsible for initiation of the currently appropriate action.

The measures taken included the firing of deceptive signal rockets,[459] the simulation of antiaircraft gun muzzle fire, the setting of simulated fires and the simulation of smoke from active fires, and the simulation of bomb explosions.

The personnel were billeted in cantonments situated in the neighborhood and well camouflaged. As a rule, dummy

458. Karlsruhe Document Collection: "~~Die LS-Truppe z.b.V.~~," by Hans Worringen, 1956.

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340 installations were designed only for purposes of deception at night, and care had to be exercised to insure that they would not be detected from the air during daylight by reason of the installations themselves or by the presence of troop cantonments. Concrete structures were essential for command posts and for the operating stands.

Personnel in and for the companies received training in the 1st Passive Air Defense Replacement Battalion at Wurzen.

It is essential for units of this type to have wireless signal communication equipment, since frequent interruptions of the wire networks would preclude proper control of the means employed.

In spite of grievous losses, the personnel in these units performed their duties loyally, although many of them were overage.

d. ~~Bomb Disposal Details~~. While preparatory work for mobilization was proceeding, personnel in Air Inspectorate 13 within the Office of the Reich Minister for Aviation investigated the development of bombs abroad and made their findings available to the three branches of the military establishment for transmission to their bomb disposal squads. The technical personnel involved here were qualified in the engineering features of arms and ammunition, so that no difficulties were en-

459. See VIIIa,3, aa, bb, cc, below.

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342 encountered in training them in short courses on the disarming of foreign types of bombs. Training in this subject was considered a matter of secondary importance at the time, because the higher level command authorities thought it unlikely that large bombings of German territories would take place. Plans at the time provided for repair and salvage personnel of the Safety and Auxiliary Services to uncover unexploded bombs. A specialist was then to be sent for from the nearest military establishment to disarm the bomb.

This arrangement was retained during the war, and resulted already in 1940 in heavy casualties caused by the detonation of the first delayed action bombs.[460] Personnel losses suffered by the Safety and Auxiliary Services in the exposed areas became increasingly intolerable, for which reason small specialized units were established to handle the removal of dud and delayed action bombs. The number of such units had to be increased later, particularly in the heavily attacked areas.

The units thus established were given the misleading designation of "Blasting Detachments (Sprengkommando). Their mission was less one of blasting than of disarming and removing bombs.

The personnel in these bomb disposal units received

460. See VIII, e, 1, 2, 3, below.

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342 training in special courses conducted at the Air Force Technical School (~~Fliegerwaffentechnische Schule~~), Halle on the Saale. Particularly capable and qualified personnel of the Safety and Auxiliary Services were also detailed for participation in special courses, where they had the opportunity to qualify in the subject of disarming impact detonation bombs. Later in the war the school was transferred to Dresden-Nickern.

As a rule a bomb disposal squad consisted of one or two officers and 10-12 men. In the final phases of the war each air district command had available from two to four such squads

As the enemy continued the development of their ammunition for air delivery, the bomb disposal squads suddenly found themselves confronted with the fact that the techniques of mine warfare were being applied in land warfare. Each of the frequent innovations in the construction of enemy bombs created new problems for the squads. In each case it was inescapably essential to obtain possession of at least one of any new type of detonator in an undamaged condition. It is hard to conceive the silent heroism required to detach a detonator of unknown construction from a live bomb, an operation in which many a well trained bomb disposal technician has lost his life. It would be possible to compose a heroic epos on the devoted men of those days, on their courage and human greatness.

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343 The bomb disposal squads suffered grievously heavy losses. Hardly one of the officers commanding the first such squads organized lived through the war. The chances were always 99 out of 100 that the bomb would explode while its delayed-action detonator was being removed, and the detonators became steadily more and more complicated. This work required a very especial gift, combined with keen intuition, and a certain measure of good luck to avoid an untimely detonation. Losses among the personnel of the Safety and Auxiliary Services (later Passive Air Defense Police) repair and salvage branch who had received training in the subject of bomb disposal also increased considerably.

With the growing frequency of air attacks the number of bomb disposal squads available was no longer adequate, although the various air district commands supported each other through temporary transfers of these units. It was thus unavoidable that the Passive Air Defense Police had to be called on with increasing frequency in urgent cases, and also with increasing frequency had to render supporting services.

Operations of the bomb disposal squads were governed by the regulations contained in Air Field Manual L. Dv. 764 and instruction sheets issued supplementary to that manual.[461]

461. Appendix 38 and Annex A: "~~Verzeichnis der L. Dv.~~".

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344 THE EMPLOYMENT OF CRIMINAL PRISONERS

Recommendations had long been submitted to employ criminal prisoners considered unworthy to bear arms and who volunteered for the purpose at digging out and uncovering dud bombs. These recommendations were only put into practice in 1941. After a period of familiarization the prisoners thus employed usually rendered good services. They were rewarded by a certain measure of freedom, good food, and rations of alcoholic beverages and tobacco, and in some cases their sentences were reduced. For these reasons volunteers were always available.

The rumor is naturally untrue that "specialists" such as professional burglars were used for the purpose because of their adeptness with their fingers. No criminal prisoner was permitted to touch the detonator of a bomb, even if it was of the simplest impact type. In all cases such prisoners were employed exclusively at digging in the presence of a bomb disposal specialist.

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345 VI. TRAINING.

Success in all passive air defense activities hinges upon the thorough training of all passive air defense personnel, extending from individual training for the rank and file to training for the higher echelons of command. It is necessary to differentiate here between

Functional technical training and
Command training.

The foundation in all cases was practical training, which culminated in a technical mastery of the equipment used and in proper passive air defense discipline in the use of such equipment.

Besides this it was important to give noncommissioned officer personnel training in the "tactical employment" of their "weapon", meaning the proper commitment of their units, and in finding the most appropriate damage control methods to be applied in any of the widely varying sets of circumstances they were likely to encounter, and to exercise them in such activities.

(a) The decisively important requirement for smooth and above all quick action by large, numerous, and differing units and sub-units was proper training for the officers. The important point here was an ability to size up and appraise a situation quickly, development of the will to

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345 make personal decisions unhampered by administrative considerations, to estimate time requirements for transportation and march movements, while the subjects of supply and replacements also had to be kept in mind. On the civilian side an officer corps with training in these subjects existed only within the regular police. The requirement here now was to extend the training program to include instruction in the necessary technical services.

346 1 In this training map and field exercises played a large role. Right from the incipient stages of the civilian air defense system the Reich Minister for Aviation and Commander in Chief of the Air Force therefore took advantage of every possible opportunity to carry out passive air defenses exercises, whenever possible integrated with maneuvers of the military forces. This was the only possible way to train all forces in integrated action, to try out the command organization, and to prepare command personnel of all ranks and all branches for their missions, which became of greater scope and increasingly difficult as time passed. The following regulations were established, which were adapted continuously in line with the latest experience:

Air Field Manual L. Dv. 770: Regulations for Passive Air Defense Exercises (~~Bestimmungen fuer Luftschutzuebungen~~) Part I: Planning and Execution (~~Anlage und Durchfuehrung von Luftschutzuebungen~~).[463]

462. L. Dv. 770/1

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346 Air Field Manual L. Dv. 752: Training Regulations for Passive Air Defense Units (Ausbildungsvorschriften fuer die Luftschutzeinheiten) plus a number of annexes for the various specialized subjects involved.[463]

It was an especial necessity to establish uniform procedures for the various specialized subjects, since the specialist teams from the various passive air defense organizations (from the passive air defense troops, the passive air defense police, the firefighting police and the factory air defense system) also had to be subject to uniform conditions for their tactical cooperation. As an example, attention is drawn here to a decree issued by the Reich Minister for Aviation and Commander in Chief of the Air Force on 24 April 1943 concerning the employment of firefighting forces against large fires. The decree was issued under the title "Basic Rules to insure the Effectiveness and Development of

347 Firefighting Forces for Action against Large Fires (Grundregeln fuer die Kampfkraft und die Entwicklung von Feuerloeschkraeften zur Grossbrandbekaempfung)[464] The basic rules dealt with the tactics to be employed on the basis of graphically explained examples. They were applicable to the passive air defense troops, the firefighting forces of the various other passive air defense organizations and to the

463. See Annex A.
464. IV, b, 1, above.

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348 local and regional control authorities of passive air defense for the commitment of complete firefighting units.

That complications of the most varied type resulted with the various responsible authorities in the compilation of regulations of this nature is only natural and was due to the form of the existing organization.

The off-post employment of small and large passive air defense units in mobile operations gained steadily in importance. The important point now was to make the experience gained in frequently attacked areas, and the methods of passive air defense operations found to have been most effective in practice there, available in time to those responsible for the direction of passive air defense in areas which had not yet come under attack, in order to avoid the errors usually made when a place came under attack for the first time. This was done by means of war games and situation critiques, conducted primarily by the air district commands and on a lesser scale by the commanders of regular police.

Even prior to the war great importance had been attached to the realistic simulation of actual damage and of conditions as they would actually be in the case of air attacks.[465] The majority of the staffs and smaller and larger units participating in or directing such exercises and-or maneuvers had

465. Karlsruhe Document Collection: "Die Schadendarstellung bei Luftschutzuebungen" 1. Fassung 1939. Air Field Manual L.Dv. 770, Teil 4.

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347 no experience in this field. The Reich Minister for Aviation and Commander in Chief of the Air Force therefore published, through Air Inspectorate 13, a regulation entitled "The Direction of Maneuvers and the Umpire Services (Leitungs- und Schiedsrichterdienst)."[466] Maneuvers were carried out for the first time in Ea tern Prussia. Later, agreements with the Army and Navy enabled passive air defense forces and organizations to participate in numerous local and regional field exercises and maneuvers. A concurrent purpose in this arrangement was to give added status to passive air defense, a subject considered as of secondary importance within the armed forces. Lacking this status, the whole system would have been irresponsibly neglected in the matter of personnel, funds, and raw materials allocations. The central authority for training was the Reich Institute of the Air Force for Passive Air Defense.[467]

The training mission could be assigned only to an authority very closely integrated with the Reich Air Ministry. This insured that the regulations published by the Reich Minister for Aviation and Commander in Chief of the Air Force, as well as the principles established by that Office concerning the organization, training, command, and equipment of the civilian passive air defense system and the integration of

466. Karlsruhe Document Collection: Air Field Manual L. Dv.770 Teil 2 "Leitungs-und Schiedsrichterdienst."
467. See III, g, above.

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348 passive air defense with the command organization of the Air Force would speedily become generally known and accepted in all agencies involved.[468]

In order to insure proper coordination of all corporations, units, and organizations involved, it was also necessary to establish uniform definitions of concepts.[469]

349 The regulations and directives issued on the subject of training served their purpose well. However, this is due not to the regulations alone, but to the tireless efforts of all participants in the training program, who loyally performed their duties in spite of the steadily increasing severity of the conditions under which they had to operate.

b. ~~The Individual Organizations~~ of the passive air defense system all had their own educational and training establishments, all of which conducted their training programs in accordance with instructions and directives from the Reich Minister for Aviation and Commandxr in Chief of the Air Force/ Air Inspectorate 13, and in line with uniform principles established by the Reich Instotute of the Air Force for Passive Air Defense.

Two training and replacement battalions existed to give training to officer personnel for the passive air defense[470]

468. Karlsruhe Document Collection: Vortragsdisposition: Wesen und Organisation des Zivilen Luftschutzes, Oktober 1936.
469. Appendix 12:"Bestimmungen im Luftschutz," Rd. Erl. R.d. L.u.Ob.d.L. (L.In.13) 31.5.1944.

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349 troops:[470]

(1) For the Passive Air Defense Warning Service training took place in basic requirements at the Passive Air Defense Warning Service Replacement and Training Battalion.[471] A passive Air Defense Warning Service School for Female auxiliaries was available fo train women. Other training within the air district commands was given in continuous courses arranged by the passive air defense staff sections (Ia op 3) of the various air district commands.

(2) Of particular importance were the training establishments of the Passive Air Defense Police. The center at which higher echelon commanders received training was in the premises of the Passive Air Defense Academy in Berlin, and transferred after the destruction of these premises during an air attack to Oranienburg. This central school was controlled by the Chief of German Police. As a rule, the courses conducted at this school lasted two weeks.

The mission of the school at Berlin, and later at Oranienburg was to give local passive air defense chiefs, officers of the regular police, the chiefs of technical services within the Passive Air Defense Police training which would qualify them for their command missions, and to familiarize them with the currently latest experience. If for no other reason the establishment of this school was necessary because the training battalion of the Reich Institute of the Air Force for Passive Air Defense was already overburdened with

470. See, V, above. 471. See IV, a, above.

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359 the responsibilities of its other far more comprehensive missions. The Passive Air Defense School of the Reich Minister for the Interior (Chief of German Police) thus represented a valuable supplement in the field of training and performed its mission satisfactorily right up to the end. Its mission in no way overlapped those of the Reich Institute of the Air Force for Passive Air Defense, since the two organizations cooperated very closely and supplemented each other. Problems of who was the proper authority had no adverse influence on functional training activities.[472]

Within the military area commands passive air defense schools were maintained at the headquarters of the various commanders of regular police, at which the command and subcommand personnel of the ~~[illegible]~~ passive air defense police received continuous training. Special courses were conducted here for those police officers who were to head the special operations staffs which became necessary in the last years of the war.[473]

Independent from the above arrangements, regular training was given to all organizations by the local passive air defense chiefs.

The Training Center of the Firefighting School at Ebers-

472. See III, b, above.
473. See III, c, 3, above.

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350 Eberswalde gave training to fire chiefs of the Firefighting Police, the Passive Air Defense Police, and the Passive Air Defense Guard Service (Luftschutzwacht),[474] and a special training field was established for the purpose in the Tucheler Heide area. At the regional level numerous firefighting schools[475] insured that all command and sub-command personnel in the firefighting services received thorough advanced training.

The Reich School of the Technical Emergency Service, already in existence in Belzig near Berlin was used to give advanced training to personnel of the repair and salvage branch.

(3) For the Factory Air Defense System the Reich Board of Industries, responsible in this field, had established a central school in Berlin to give advanced training. Command and sub-command personnel at the intermediate levels received advanced training in the subjects of factory air defense at the regional factory air defense schools. Local training was a responsibility of the local passive factory air defense agencies.

(4) The Reich Passive Air Defense Society, responsible for the organization and training of persons in the

474. In what were formerly designated Category II and III Passive Air Defense Localities. See III, c, 4, above.
475. Karlsruhe Document Colle tion: US Strategic--Continued

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351 individual or self-protection system, had developed a comprehensive school service. Control personnel in the self-protection system received advanced training at the Reich Passive Air Defense School, located initially at Berlin-Wannsee and later in Jena. This school had all modern equipment and visual aids and had a promoting influence on the lower echelon schools at the state group, regional group, and local group levels.

The Reich Passive Air Defense School in Berlin was under direct control by the Presiding Council of the Reich Passive Air Defense Society. Its primary mission was to train higher level officials of the Society and, through appropriate courses, to insure uniformity in all training measures. Each state group of the Society maintained a state group passive air defense school. Local chapters or groups of the Society had central passive air defense schools (Luftschutzhauptschulen). These schools trained the various group officials, such as block wardens, sub-group chiefs, consultants on passive air defense building construction, and units which were responsible for the training of all participants in the self-protection system. The actual training of these personnel took place in the

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352 passive air defense schools.

(5) As "special administrations" the three branches of the military establishment--the Army, the Navy, and the Air Force, educated and trained their own personnel independently in accordance with instructions received from the Reich Minister for Aviation and Commander in Chief of the Air Force, and with support from the Reich Institute of the Air Force for Passive Air Defense. For example, Chapter VII of the Guide for Instruction in Air Force Service Schools (~~Leitfaden fuer den Unterricht an den Luftkriegsschulen~~) contained a section entitled Civilian Air Defense,[476] and all class members were furnished appropriate bulletins.[477]

The other "special administrations", such as the Railway and Postal Services, also trained their own command and auxiliary personnel under their own responsibility for their passive air defense missions, also with support from the Reich Institute of the Air Force for Passive Air Defense. As a rule these personnel participated in field exercises and maneuvers and other large-scale training events, and also participated in passive air defense activities within their respective localities.

The training system briefly outlined in the past few pages made it possible to give training to wide circles,

475.-Continued from p. 487: Bombing Survey, Civilian Defense Division Final Report, where details are given also on the whole field of training activities.

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352 besides familiarizing the active forces with all newly acquired experience, and giving them practice in the application of such experience. It is due to this system that the

353 German Passive Air Defense Services achieved their uniquely high standards of performance in spite of all the other difficulties encountered.

VII. THE SUPPLY, RESUPPLY, and REPLACEMENT SYSTEM.[479]

In the matter of apparatus, motor vehicles, special type vehicles, and standard and special items of equipment needed for passive air defense purposes, it is necessary to differentiate between the initial issue and the wartime resupply services.

a. The subject of the initial issue of equipment, etc., for the various passive air defense branches has been dealt with in the appropriate chapters of this study. The whole situation can be summarized briefly as follows:

(1) The Passive Air Defense Warning Service received its supplies through the Office of the Reich Minister for Aviation and Commander in Chief of the Air Force, with support from the Reich Post and Telegraph Service in matters of signal communications. Special types of equipment and vehicles were ordered directly by the Reich Mi-

476. Karlsruhe Document Collection: "Ziviler Luftschutz," excerpt from Chapter VII.
477. Ibid : "Merkblatt ueber Flugmeldedienst, Luftschutzwarndienst, Ziviler Luftschutz."
478. See IV, f, and IV, f, 1, above.

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358 Minister for Aviation and Commander in Chief of the Air Force from the manufacturing firms, who delivered them directly to the various passive air defense localities.

The main items involved were stationary and motor vehicle sirens, and other items of equipment for the warning posts.

(2) For the Category I Safety and Auxiliary Services, local organizations and establishments already in existence were used. Supplementary equipment, and particularly supplementary motor vehicles were ordered in accordance with customary peacetime routine; after call up of the Passive Air Defense Services such items were requisitioned under the laws regulating the requisitioning of property and services for defense purposes. No issue of equipment and motor vehicles could be made to Category II and III localities. Owing to the small allocations received, these localities had to be neglected in favor of areas of main effort.

The following applied in the case of the individual sub-organizations of the Safety and Auxiliary Services:

The actually available fireengines in the firefighting services were increased to the authorized numbers by deliveries through the Reich Minister for Aviation and Commander in Chief of the Air Force/Air Inspectorate 13, of

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354 newly developed and tested types of vehicles with better performances. The same applied in the case of special types of vehicles and equipment.

For the Repair and Salvage Branch special types of vehicles were developed with support from the Technical Emergency Service and delivered after proper testing.

For the Decontamination Service the same applied, with the proviso that calls were made on the various road cleaning agencies.with their vehicle and equipment depots. The Decontamination Se vice was an entirely new establishment, for which the special items of equipment, vehicles, and protective clothing (against gas) had to be developed and delivered.

The Passive Air Defense Medical Branch and the Veterinary Branch had to be furnished supplementary instruments and other medical supplies.

Particularly large supplies became necessary to fit out the various stationary establishments of the above organizations, such as repair and maintenance depots, first aid stations, decontamination depots, commodity decontamination centers, auxiliary hospitals, examining stations of the most varied types, and medical and veterinary supply

479. Karslruhe Document Collection: "Das Versorgungs- und Nachschubwesen des zivilen Luftschutzes," by Oberregierungsrat Hans Wickel, 1926.

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for the repair and salvage through special types of vehicles were developed with support from the technical emergency service and delivered after proper testing.

For the decontamination service the same applied, with the proviso that only units were made on the various road cleaning agencies with their vehicle and equipment depots. The decontamination service was an entirely new establishment, for which the special items of equipment, vehicles, and protective clothing (Ausrüstung gas) had to be developed and delivered.

The Reserve Air Defense Radical Search and the Veterans Army Search had to be furnished supplementary instruments and other medical authority.

Particularly large supplies became necessary to fit out the various auxiliary establishments of the above organizations, such as repair and maintenance depots, first aid stations, decontamination depots, commodity decontamination centers, auxiliary hospitals, examining stations of the most varied types, and medical or veterinary supplies.

479. Reichsbund Document Collection: "Das Verzeichnis von Luftschutzwaffen des zivilen Luftschutzes," by Oberregierungsrat Hans Wiesel, 1936.

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354 depots.

(3) The supply of equipment for the Factory Air Defense System, and for the Self-Protection and Extended Self-Protection Systems was directed centrally from the Office of the Reich Minister for Aviation and Commander in Chief of the Air Force by Air Inspectorate 13. Factories had to pay for their own equipment, for which they received conpensation in the form of tax reductions. The Self-Protection and Extended Self-Protection Systems paid for their own equipment.

(4) The "special administrations" procured their own passive air defense equipment, and maintained adequate stocks, inaaccordance with directives and instructions from the Reich Minister for Aviation and Commander in Chief of the Air Force.

b. ~~Resupply for Civilian Air Defense~~. The above description applies to the situation existing when World War II broke out. However, difficulties had arisen already in 1938 in the matter of allocations of raw materials. Because of the accelerated pace of rearmament in all three branches of the military a situation necessarily developed in which the already small supplies of raw materials were no longer adequate for the rearmament of all military branches in addition to the requirements for consumer commodities. Consequently,

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355 the Supreme Military Command drew up a ten-point program establishing the allocations to be made in order to insure completion of all military programs simultaneously or in order of importance and basing its finding on the current appraisal of the importance of the armed forces as compared with the requirements of passive air defense. In spite of vigorous protests by the Inspector of Passive Air Defense, the service was awarded tenth priority in this program.

This very seriously complicated the build up of the passive air defense system, with the result that it was inadequately equipped at the outbreak of war. Furthermore, the low priority awarded had made it impossible to carry out the intention to stockpile reserve supplies in special depots.

It was completely obvious to Air Inspectorate 13 at the time that the current methods of centralized procurement and direct delivery of passive air defense vehicles and equipment from the manufacturers from current production would prove inoperable in the event of war.

356 The Chief of Air Force Supply and Administration at the time refused to accept the responsibility for supply and resupply functions for the "civilian" air defense service to be handled through the existing installations of the Air Force, although this arrangement was provided for in Special

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356 Annex X to the Mobilization Plan (Air Force).[480] The only remaining course was, therefore, to establish separate supply channels, in particular for the Safety and Auxiliary Services, with their planned authorized strength of 220 000. With approval from the Organizational Division of the Air Force General Staff, Air Force Inspectorate 13 thereupon established supply and resupply depots, which were designated

Passive Air Defense Equipment Depots.

By the end of 1939 these depots were operable in organizational, administrative, personnel, and materiel respects. At that time the depots were not an establishment for the troops, but were organic to the Safety and Auxiliary Services.

As the designation implies, the newly established supply system handled only equipkent specifically for passive air defense purposes. Medical equipment was handled by the Air Force medical supply depots responsible in the various air district commands, and clothing supplies by the appropriat Air Force clothing offices (the latter for the Passive Air Defense Warning Service and for the Safety and Auxiliary Services).

It was now possible to direct vehicles and equipment supplies coming from current production to the appropriate Air District Commands in accordance with expected requirements. Unfortunately, however, deliveries fell far short of

480. See II, b, above.

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356 actual requirements because of the low priority awarded to the service. Repeated efforts finally resulted in an increased industrial output of the items required, so that the requirements of the passive air defense equipment depots were met in about 1940.

An equipment depot was established for each air district command within the Zone of Interior, with the exception of Air District Command I, at Koenigsberg, Eastern Prussia. In addition, one depot was established in Austria, and one in the Protectorate of Bohemia and Moravia. The depots proved particularly important for the activation and commitment of new motorized units of the Safety and Auxiliary Services.

In 1942 the passive air defense equipment depots were integrated with the Air Force. This measure resulted from the incorporation of the Safety and Auxiliary Motorized Battalions into the Air Force and a considerable increase of the passive air defense troops. From this point on the depots were responsible for supplies not only to the motorized passive air defense battalions, but also to the smoke battalions, and to the Special purposes passive air defense battalions employed in the maintenance and operation of dummy installations. Concurrently, the depots handled supplies for the former Safety and Auxiliary Services, which had meanwhile been redesignated as the Passive Air Defense Police.

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357 With the increasing severity of the enemy air attacks the necessity arose to decentralize the passive air defense equipment depots. Two field depots were established for each existing depot and the available vehicles and equipment were so stored that even if a main depot or one of the field depots within a supply area were destroyed supply operations would not be disrupted. Experience showed that the selection of locations for the depots and also the layout of the various depots reflected a correct estimate of the air threat. Only one main and one field depot were struck by incendiary bombs, which were extinguished before any damage was done.

358 Organizational changes made in the top command echelons of the passive air defense system in February 1945 influenced the service supply channels.[481] The passive air defense equipment depot system was again taken out of the Air Force budget and transferred to that of the Passive Air Defense police. This resulted in the anomalous situation that depots, now under the Chief of German Police, remained responsible for supplies to the passive air defense troops (motorized passive air defense battalions, the special passive air defense battalions, and the smoke battalions), as well as to the Passive Air Defense Warning Service, so far as items of special equipment were concerned, because no other operable arrangement could be made for the time being. In order to avoid

481. See III, a, 3, above.

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358 interruptions in the flow of supplies, the Air Force personnel who had hitherto handled supply matters for the service were detailed temporarily for duty with the Passive Air Defense Police. The raw materials allocations were to be transferred later to the Reich Minister for the Interior (Chief of German Police). A more unfavorable time for any measure of this type could not have been chosen.

Establishment of the passive air defense equipment depots proved a sound measure. In any future system it will be necessary, however, to establish clearly defined supply channels from the very outset, and not to put off the build up of supplies in the depots until the last moment.

VIII. THE TECHNICAL BRANCHES OF THE GERMAN PASSIVE AIR DEFENSE SERVICES

A. Building Construction for Passive Air Defense Purposes[482]

In the incipient stages of German civilian air defense the Office of the Reich Minister for Aviation and Commander in Chief of the Air Force found itself confronted with particularly serious problems in the field of building construction. Very little experience was available on the subject, although certain trains of thought had been developed in foreign countries, and although the pertinent German societies had concerned themselves with the problems specific

482. Karlsruhe Document Collection: "~~Bautechnischer Luftschutz~~," in "~~Handbuch der neuzeitlichen Wehrwissenschaft~~," ~~Dritter Band, 2. Teil~~, 1939, pp. 8-14.

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359 to building construction to meet the demands of passive air defense. The important requirement now was to state the problem clearly, issue appropriate instructions and directives to the responsible agencies, procure the necessary funds, raw materials, and personnel, and expedite the initiation of all necessary measures.

The mission was to exercise an influence on all building activities in all German territories which would bring about a steady decrease in sensitivity to air attack. It was essential that the principles of air defense should determine all preparations, plans, and execution of new structures intended to serve the German Nation, its economy, and its defense in any way. It was also important to reduce the sensitivity of existing buildings to air attack as far as possible.

Requirements therefore had to be stated in the following fields:

(1) Planning and lay out in all building programs within Germany;

(2) Application of the proper principles in all large-scale settlement projects, such as township developments, reconstruction in cities, new settlements;

(3) Measures to protect production and traffic;

(4) Measures to insure adherence to the principles

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359 in the details of every individual structure;

(5) Measures to protect the population (the construction of air raid shelters).[483]

360 Once a clear concept of the mission had crystallized,[483] the Reich Minister for Aviation and Commander in Chief of the Air Force lost no time in issuing, through Air Inspectorate 13, in cooperation with the appropriate central Government authorities, and with support from the Reich Institute of the Air Force for Passive Air Defense,[484] the directives essential to insure proper application of all necessary measures. As e perience became available, the directives thus issued were modified or supplemented.[485]

In a speech the Reich Minister for Aviation and Commander in Chief of the Air Force formulated his ideas on the subject of building construction for air defense purposes briefly as follows:

In the future it must be impossible for one stone to placed upon another without thought of passive air defense.

1. ~~The Passive Air Defense Mission in Area Planning and Township Developments~~.

It was necessary to differentiate between overall area planning and organization for the whole of Germany, a responsibility of the Reich Office for Regional Planning (~~Reichsstelle fuer Raumordnung~~) on the one hand, and what was called functional planning (for example in the case of township develop-

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360 development) residential area, and settlement area planning, and traffic and communications layout), matters which were handled by the various appropriate professional departments but which had to be fitted into the overall program of regional planning.

In addition to preservation of the military potential, an important objective in passive air defense from the very start was to provide safe shelter for the civilian population. Although the existing complexes of mass settlements and centers of manufacturing and other production centers, and centers of supply and communications had to be considered as particularly sensitive to the hazards of air attack, Germany's situation in respect to the magnitude of the dangers made it imperative to also extend all passive air defense measures to all other residential and working areas.

For the above reasons the problem of safe shelter for the civilian population could only be solved on an areal basis and not by means of a program of consecutive progress, which would have been more natural, and personal desires had to subjected to the overruling requirements of the whole Nation. All construction projects submitted for approval, whether they concerned an individual house, or the plans of a small or large

483. "Der Luftschutz im Bauwesen," Ministerialrat Loefken," in Knipfer-Hampe, "Der Zivile Luftschutz," p. 307.
484. See III, g, above.
485. A compilation of all pre-1939 measures will be found in Karlsruhe Document Collention: "Bautechnischer Luftschutz, (vor 1939)", by Lt. Col. Greffrath, 1954.

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361 group or community, were approved only if they fitted completely into the overall plan.

Those responsible for passive air defense had concerned themselves with this realization as early as in 1936. The logical starting point in their considerations was that the closely settled major cities, which at the same time were the main centers of industry and traffic and communications, represented the main points of danger. The matter of reorganizing the form and content of these cities was therefore not only a requirement of area planning, of city hygienics, but above all a problem of passive air defense. The target was to bring about better spacing, to simplify, and to bring creative planning into play. The paramount principles had to be: to prevent any massing of people and industries; to keep residential and factory areas separate; and in this way to reduce sensitivity to air attack. This applied not only in the case of newly planned projects, where the lay out was to be such that large-scale damage could not occur, and it was action in such large-scale damage areas that so much effort had to be expended during the war. Measures also had to be taken to remedy what had been neglected or wrongly planned in the past. Therefore the reorganization of old cities was an important requirement, also from the viewpoint of passive air defense.

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362 Hamburg-Altona carried out a program of reorganization which was exemplary in this respect. Here the heavily overcrowded slum section of the old town disappeared with its narrow and crooked alleys, its dark and sunless back yards, and unsanitary rear buildings to make way for a widely spaced settlement with rows of houses, which met most requirements in the fields of town planning, hygienics, traffic and communications, and passive air defense. In carrying out the program it was found that it was not always possible to completely remove all traces of the old unsatisfactory structures and replace them by the new ideal. In such cases great improvements were made by removal of rear buildings and of houses which had been constructed leaning against the narrow end walls of blocks of buildings. This made it possible to create new open spaces.

The defined mission called for long-range creative planning to organize or reorganize all regions and towns in line with the final target. This meant that the individual problems of building construction for air defense purposes as they occurred in national and state planning in the development of townships, and in the layout of settlements, could not be solved individually, but only as part of a natural complex and with due regard to the technical, economic, and passive air defense requirements. The innumerable problem which were encountered here, the way in which many of them overlapped, and their complete novelty, categorically required a mutuality of effort

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362 in all fields of passive air defense, including the Self-Protection, Extended Self-Protection, and Factory Air Defense Systems and all other participants in the apssive air defense effort. Intricate interrelations were frequently hard to discern, and this made it necessary to establish a construction program for the structural measures intended for passive air defense purposes.

The passive air defense construction program for a city had to be well considered and compiled with a view to the future. National interests had to take precedence over personal desires, the requirements and existing danger zones had to be ascertained, and on the basis of such findings the type and size of the structures to be constructed, and the sequence and rate of construction had to be recommended or established by orders.

As a rule the procedure in working out a passive air defense construction plan for a city was as follows:

(a) The following information was entered on the appropriate sectionsof the town map:

(1) The number of persons living in the area and the population density per unit of space;

(2) The number of buildings per unit of space;

(3) Industrial and other works in the area together with the number of persons employed and classified as

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363 military, armament, other vitally important, and other works.

(4) The locality of Government and administrative buildings, telephone exchanges, hospitals, etc., and all other particularly important establishments or installations.

(5) Culturally important buildings, with details on the works to be protected.

(6) Existing possibilities to afford protection for human beings, animals, and property.

(7) Traffic media, such as rail roads, Autobahn superhighways, main roads, bridges, other important engineering structures, together with details on traffic density.

(b) An analysis of the above information in combination with an appraisal of the geographical position and importance of the city concerned made it possible to draw informative conclusions on the sensitivity of the city to air attack and the degree to which it was endangered. On the basis of these findings it was determined what scope of passive air measures were needed, and it was possible to compute the funds and ways and means required to meet the established requirements in a proper sequence of importance.

The person responsible for the compilation of a "City Passive Air Defense Plan" was the Lord Mayor as the local

364 passive air defense chief. In this work the Lord Mayor in the first place consulted the appropriate planning departments

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364 of the Reich Office for Regional Planning . In the detail problems involved he was supported by the appropriate Board of Works and by the construction specialists of the Civilian Air Defense System (in particular by the Passive Air Defense Building Construction Advisory Councils of the Reich Passive Air Defense Society).

As a rule, the largest part of the preliminary work involved for a "Passive Air Defense Building Construction Plan" was that of determining the density of population in houses and the existing possibilities available to the population for self-protection. Besides providing for protection of the human and animal population, measures had to be taken at the same time to protect and store food, collections, works of art, etc.

In the non-technical parts of the statistical analysis it was necessary not only to inquire into the number of homes and persons within an area, but in particular to establish the population density. In calculating the shelter requirements, the highest figure thus obtained was broken down to show the percentages of men subject to the draft, persons for the self-protection system, persons who would move to the country in the event of acute danger, etc.

The technical part of the analysis was concerned with ascertaining where and to what extent suitable shelter could

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364 be provided at the least cost and with the least complications for the human population and objects of value. For this purpose it was necessary to conduct an inspection of each house, each cellar, and all natural or manmade structures , such as caves, rock tunnels, disused mine shafts, and underground parts of former fortification works already in existence which could serve as shelters.

In computing the maximum floor space available in cellars for the construction of shelters, it was necessary to subtract an appropriate percentage to allow for the space which would be needed in every cellar and even in the event of an acute threat for the storage of such items as food and coal.

The information gathered by the means described above also provided a valuable basis for the planning of large public air raid shelters. Other problems which could be taken care of at the same time were those of fire prevention, blackout facilities, etc.

Large numbers of qualified personnel were needed for the gathering of all this statistical data. The quickest and most practicable course was adopted in Saxony for the first time. The Reich Passive Air Defense Society assigned its officials and advisors on building construction to obtain the necessary information on subjects within its areas of responsibility.

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365 I. IMPORTANT REQUIREMENTS IN THE EXPANSION OF CITIES!

(1) Long-range planning.

(2) Consideration must be given to higher echelon requirements of regional and state planning.

(3) Residential and industrial areas should be kept apart.

(4) The town area should be interspersed with green spaces, and as many large open spaces as possible should be provided.

(5) Care should be taken to avoid the massing of population, industries, and traffic.

(6) Military, armament, and other vitally important factories and other works should not be too densely concentrated.

(7) The construction of buildings in the neighborhood of factories and other works and installations should be prohibited.

(8) Care should be taken to provide wide traffic spaces, broad streets, and secure approaches to all buildings and other structures.

(9) The most frequent direction of the wind should be taken into consideration in all building projects.

(10) Rail depots should be in the outskirts of a town; installations of the health services should be outside of a town.

II. MEASURES TO IMPROVE CITY AREAS!

(1) Deccease the size of the center of the city.

(2) Decrease the population density.

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366 (3) Establish maximum utilization standards.

(4) Remove or thin out too densely crowded blocks of buildings.

(5) Endeavor to secure widely spaced rows of houses.

(6) Avoid the creation of closed dark, sunless, back yards more or less inaccessible to air.

(7) Build broad strets.

(8) Insure easy accessibility to all building plots.

(9) Do not build houses to close gaps between existing houses if this is contrary to passive air defense interests. Instead rebuild if possible.

(10) Prevent the creation of blind alleys caused by buildings constructed at the ends of streets.

III. SETTLEMENTS

a. ~~Urban Settlements~~.

(1) Establish purely residential settlements.

(2) Prescribe minimum distance from important industrial installations.

(3) Have all new structures properly spaced.

(4) Place limit on population density and on use of ground for building.

(5) Build broad streets in the main direction of the wind.

(6) Insure that the whole settlement can be well aired.

(7) Provide speedy transportation to insure exploitation of the cultural advantages of the city.

b. ~~Rural Settlements~~.

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367 b. Rural Settlements.

(1) Avoid creating villages of crowded houses.

(2) Create a well spaced layout of farms around a village center point.

(3) Insure that the houses blend naturally with the surrounding scenery.

The directives compiled in April 1935 by the Reich Committee of Works under instructions from the Reich Minister for Aviation and Commander in Chief of the Air Force defining the missions of national, state, and regional planning, local and industrial planning, city improvement, and the protection of buildings against the effects of air attacks required many years for execution and could only be realized in the future. Large funds and an army of workers would have been needed.

It is therefore only natural that only a very small part of the gigantic program was completed by the beginning of the war, since the time had been all too short. Very soon after the outbreak of war the highest authorities realized that an Emergency Program would have to be established for the planning and execution of passive air defense construction projects in place of the preveiously established measures, which had been projected for completion over a long period of peace.

In the case of communications and supply planning, the following principles still apply:

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367 All traffic and all communications must be decentralized. Traffic concentrations must be avoided. Whenever possible traffic routes must be flanked on either side by open spaces. New installations must be constructed at a distance from traffic routes, and must have multi connections with the general routes.

368 The connecting routes must be spaced widely apart and the points at which they join the main route must be so wide apart that they will not all be endangered simultaneously in an attack. The routes must be blended with the surrounding terrain. Cuttings and embankments, and all other manmade structures must be avoided, since they can be recognized and hit by bombs. Supply installations and servicing installations must be so designed that they cannot be identified as such. Each should constitute a part of an integrated network, so that even if a number of them are rendered inoperable this will not disrupt supplies and servicing. For further details on this subject the reader is referred to the chapter in this study on the factory air defense system.[486]

The directives governing construction activities in the development of towns were issued by the Reich Minister of Labor, who on 28 March 1938 classified them as "For Official Use Only" at the request of the Reich Minister for Aviation. In order to make them really effective it became necessary to declassify them very soon.

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368 A general decree by the Reich Minister of Labor issued on 5 September 1942 recapitulated the former directives modified in the light of new experience.[487]

The requirements stated in the directives had an important impact on the planning and layout of towns and settlements. They required not only that inappropriate construction was to be prevented, but also that everything possible was to be done to remedy mistakes made in the past.

The general decree treated the following points:

369 (1) The basic passive air defense requirements in the development of towns.

(2) The large area layout of towns and settlements.

(3) The requirement to keep heavily air-threatened works and other installations apart from residential buildings.

(4) The requirement for wide spacing in all building projects.

The principles dealt with here are still valid today. The "Temporary Bulletin: Passive Air Defense Requirements in the Build Up of Towns (V~~orlaeufiges Merkblatt~~: L~~uftschutz im Staedtebau~~)" published by the present German Federal Ministry for the Construction of Homes in the final version of December 1952 is based on the above directives and is only modified to a certain extent in accordance with the effectiveness of modern

486. See IV, c, 2, above.
487. Karlsruhe Document Collection: ~~Richtlinien fuer den baulichen Luftschutz im Staedtebau, RdErl. d. RAM, vom 5. 9. 1942~~.

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369 weapons.

This Temporary Bulletin, which will not be treated in detail here, is organized in seven sections:

1. General Principles.
2. Organization of building areas.
3. Sites for air threatened installations.
4. Building types and methods.
5. Population density.
6. Traffic and communication facilities.
7. Supplies and utilities.
8. Passive air defense plans in township development.

The bulletin also contains explanatory material, which is of importance because of the sources quoted.[488]

In any case it can be established here that in her passive air defense provisions for township developments Germany was headed in the right direction.

2. The Passive Air Defense Mission in the Selection of ~~Industrial and other Sites~~. In selecting sites for new factories or other installations for industrial or communications purposes, or for new military establishments, very serious consideration had to be given to sensitivity of the individual installations to air attack and the degree in which they would be exposed to attack. Building sites in the vicinity of installations which were likely to come under attack could not be considered suitable for the establishment of new installations. Areas to be avoided for

488. Karslruhe Document Collection:--Continued

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380 these reasons were those in which factories or other installations of the industry, the military, the traffic and communications systems, or other vitally important installations were located.

Salient terrain features, such as rivers, canals, railroad tracks, which were easily recognizable from great altitudes, would make it easier for enemy airmen to find any target in the locality. Therefore, the site for any new installation had to be distant from any terrain features which could serve as guides.

Here again, great importance had to be attached to the possibilities of natural camouflage. The new installations therefore had to be so arranged that they would not be too conspicuous in the surrounding terrain. They had to blend naturally with their surroundings. Advantage had to be taken of the existing natural possibilities to have shadows concealed by trees or other plants. For more information on the subject of artificial camouflage the reader is referred to the chapter on this subject.[489]

Because of the relatively narrow confines and the dense population of Germany, it was naturally impossible to meet the above requirements on any large scale. The necessity to

488--Continued: "Luftschutz im Staedtebau," ~~Dritte Auflage.~~ Bauverlag G.m.b.H., Wiesbaden and Berlin.
489. See VIII, d, below.

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370 to link any new installation with main traffic routes and to provide quarters for the personnel it would employ, combined with the urgent need for speed, unfortunately made it necessary in many cases to adopt emergency solutions which later produced dire results.

This applies particularly to large area works, such as hydrogenation works and factories manufacturing Air Force equipment. The factory air defense system in existing factories was no longer able to accomplish its missions in the period of large-scale attacks, and it was impossible to maintain output at the necessary level. With the increase of enemy attack operations it therefore became necessary to move some of the more important factories, which naturally resulted in reduced production and delays in deliveries, a subject treated in more detail in the chapter on the transfer of factories.[490]

The following applied in the case of newly established factories and other installations:

> The smaller a target is and the larger the open areas are by which it is surrounded, the smaller will be the percentage of bombs by which it is hit. Therefore, all new factories were to be kept to the smallest size shown by experience to be compatible with their economical and operational requirements, and the individual works making up a factory

490. See VIII, a, 3, below.

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371 had to be spaced as widely apart as possible.

One of the most important conditions in efforts to reduce the effects of air attack is met if the space required for living quarters, for working sites, for factory operations, and for storage is provided in a number of widely spaced small buildings instead of in a few large buildings. This is a categoric requirement to reduce sensitivity to air attack for the following reasons:

a. ~~The Effects of Explosive Bombs~~. The danger of blast compression exists when buildings are too closely spaced and when they have completely or partly enclosed yards; when houses are build in closed blocks; or when the front or rear of a row of houses is interrupted by protruding parts of a building or by a building placed at right angles. Solutions must therefore be sought which will permit the free escape of a bomb's blast pressure.

b. ~~Incendiary Bombs~~. Wide spacing will prevent the spread of fires from house to house. This is also the only way to enable firefighters to approach the fires.

Furthermore, wide spacing makes it possible to provide more effective protection for the employees and to accelerate the resumption of manufacturing operations.

In selecting a site for a factory or other installation it is important to insure that the features remain

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372 unchanged which make it suitable at the time of selection from the air defense point of view. Therefore, care must be taken to insure that no other building will be allowed nearby in the future.

The first edition of Passive Air Defense Building Construction Directives to be Observed in Planning (Richtlinien fuer den baulichen Luftschutz bei den Aufgaben der Planung) was issued by the Reich Minister for Aviation and Commander in Chief of the Air Force through Air Force Inspectorate 13 as a decree on 8 January 1938 . This decree established a "protective distance" of 550 yards (500 meters) to be left between highly endangered installations on the one hand, and residential, settlement, or business areas on the other. Wartime experience in large-scale attacks showed that this distance had to be increased to 1 100 yards. The appropriate regulations were published in a decree issued on 28 August 1942[491], which also enumerated the types of factories, installations, etc., to be considered highly endangered.

It was to be assumed that any enemy would take primary action against that weapon which constituted a threat to its own factories and other targets which were of decisive military importance. In building up and expanding the industries

491. Karlsruhe Document Collection: "Luftkriegserfahrungen auf dem Gebiet der Planung," R.d.L.u.Ob.d.L., Nr.2511/42 (L.In.15/5 II Ka) vom 28. 8. 1942.

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373 supporting the German Air Force it was therefore essential tp proceed primarily in accordance with air defense principles. In line with the general principles and requirements stated by the Reich Minister for Aviation and Commander in Chief of the Air Force through Air Force Inspectorate 13, and in co-operation with the Reich Office for Regional Planning (Reichs-stelle fuer Raumordnung) and the Reich Economics Ministry (Reichswirtschaftsministerium) and the other agencies involved, steps were therefore taken to formulate the principles to be observed in planning and construction, and to initiate immediate measures for their execution. The principles thus established applied to all planning and designing, to the size and construction type of halls and sheds, of air raid shelters, of blackout facilities, to protection against fire and explosions, and to protection of electric power stations, worker
worker settlements, etc, and to the commitment of forces during and after air attacks.[492]

To serve as a model, the aircraft engine factory of the firm of Daimler-Benz Motoren GmbH., was constructed at Genzhagen, Berlin, the first construction phase of which was completed in 1936-37.

492. Karlsruhe Document Collection: "Richtlinien des Luftschutzes fuer den Aufbau und Ausbau der Luftwaffenruestungsindustrie, von Oberst Ing. z. Wv., Haase-Berton, vom 26. 5. 1955.

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373 In this case the whole factory complex was built in line with all experience available in the field of air defense and without any regard for profitability. It was due to the wise selection of the locality, the dispersed outlay with natural and artificial camouflage, and the well-considered construction and operation of appropriate dummy installations, and use of smoke screening, that this factory complex did not come under serious attack before 8 August 1944. In all previous attacks, the bombs had been delivered on dummy installations. Later, how-

374 ever, it became necessary to transfer the factory installations to limestone caves in the Mosbach-Neckarelz region.[493]

With the abovementioned decree of 28 August 1942, the Reich Minister for Aviation and Commander in Chief of the Air Force, through Inspectorate 13, furnished information on the conclusions drawn from experience in actual air warfare applicable to the selection of sites for installations which were likely to come under air attack. From then on such installations were to be established as far as possible from residential areas. According to local conditions the distance was to be at least 1 100 yards, in the case of installations where the danger of air attack was particularly acute, such as large hydrogenation plants, shipbuilding yards, aircraft factories, the distance was to be several miles.

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374 New armament factories were established in the central, eastern, and southeastern areas of Germany at the beginning of the war. Lack of time and shortages in labor and materials necessitated the construction of temporary type buildings as billets for the employees. Cantonment camps, some large, some small, were established for these purposes. A decree by the Reich Minister for Aviation and Commander in Chief of the Air Force on 4 January 1941 established that cantonment buildings were to be at least 11 yards apart, and that firewalls were to be separated by a distance of at least 44 yards. Other requirements were that the attics were to be accessible from the various fire prevention sections, that the material used in construction was to be fire-proofed, and that shelter trenches and water supplies for firefighting were to be available. On the basis of the first wartime experience the Reich Minister for Aviation and Commander in Chief of the Air Force decreed on 15 July 1941 that cantonment camps were only to be established outside of cities or at least outside of city areas particularly exposed to or sensitive to air attack.

At the instance of the Reich Minister for Aviation and Commander in Chief of the Air Force, the Reich Labor Minister on 30 October 1941 issued directives concerning fire

493. See IX, c, below.

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374 prevention and passive air defense measures required in building construction. From then on cantonment type buildings were to be spaced at least eleven yards apart at the ends, and twentytwo yards apart along the sides.

Also at the instance of the Reich Minister for Aviation and Commander in Chief of the Air Force, the Reich Minister for Armament and Ammunition ordered that cantonment camps were to be erected at sites where they would blend with their surroundings and at a safe distance from residential or industrial areas. The distance prescribed for small camps holding up to 1 000 persons was 220 yards or more, for large camps holding more than 1000 persons 550-1 100 yards or more. The deccee also established specific requirements for the grouping of the buildings, the provision of fire lanes, of camouflage, of water ponds for firefighting, and of shelter trenches.

At the request of the Reich Minister for Aviation and Commander in Chief of the Air Force, the Plenipotentiary General for Building Construction on 22 April 1943 decreed certain conditions governing the reconstruction of cantonment type buildings in areas exposed to the air threat. The decree stated that wartime experience had revealed the necessity

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375 for even more stringent passive air defense measures. Cantonment type buildings in the future were to be twice a far apart as in the past (now 22 yards at the ends, and 44 yards at the sides), and that they were to have stone or cement floors. Reestablished cantonment camps were to have no timber structures; instead they were to have temporary type masonry houses.

To preserve cantonment camps constructed under former directives and still in e istence in air threatened areas, the the Plenipotentiary for Building Construction, again at the request of the Reich Minister for Aviation and Commander in Chief of the Air Force, on 11 June 1943 issued a decree requiring the following immediate measures:

Localities were to be changed by moving the camps in part or in their entirety, even if this meant that the employees would have a longer distance to cover on their way to and from work. If necessary some building were to be demolished to secure better spacing. Camouflage effects were to be achieved by fitting the camps into their surroundings.

As the war entered its final phases it became increasingly obvious that the only real protection was that afforded by regular bunker type shelters, tunnels--if a thick enough

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376 roof of solid rock was available, and in some circumstances deep shelter trenches. These latter, however, could serve only for a short while, particularly during rain or dold weather.

On the whole, industrial installations established in caves, mine shafts, forests, and deep and narrow valleys escaped destruction. In other cases wide dispersion in most cases averted total destruction.

3. ~~The Relocation of Industrial Works~~. When the Allies commenced their war of strategic bombing, the area available to Germany had already been narrowed down considerably, and the German air defense system was no longer in any position to repel the attacks. The bombloads carried by the attacking planes grew bigger, and systematic operations commenced to neutralize and destroy German factories. At the same time traffic was seriously disrupted. Operations against German bottleneck industries were directed against fighter aircraft production, hydrogenation works, tank factories, and traffic and communications facilities and media.

The measures of passive air defense adopted were no longer adequate to insure uninterrupted manufacturing operations, and the vitally important requirement now was to radically decentralize factories and subsidiary installations manufacturing equipment, as well as all other installations produc-

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376 producing commodities of vital importance for the war effort.

The initial step taken for this purpose was to shut down whole branches of those industries which were not of direct military importance, such as the textile works in Saxony, and move factories producing armaments into their premises. How-

377 the possibilities in this direction were soon exhausted.

Finally, the only possible course left open was to move essential factories underground, under mountains, into tunnels, and into mine shafts. However, this process of relocation started too late to produce decisive results so far as the maintenance of industrial output was concerned.

The relocation of industries currently in operation is always accompanied by disadvantages. The personnel available are no longer adequate; experience showed, in fact, that personnel requirements were doubled during the first few months. An added complication in Germany was the necessity for close supervision, since of the personnel employed in the armament industries 80 percent were foreigners from 22 different nations. All other difficulties and disadvantages were aggravated by the increasingly long distances between the various mutually supporting industries, a factor which further delayed manufacturing processes.

~~Movement to Above-Surface Locations~~.[494]

Here the German system differentiated between alternate

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377 or precautionary plans and immediate plans. In the first case all preparations were to be made by a factory so that, if it were destroyed, operations could continue smoothly in alternate installations prepared beforehand for the purpose. This system of planning extended intitially to 280 factories engaged exclusively in the manufacture of items for the Air Force.

The immediate plan system applied to a number of key installations,[495] intended for immediate relocation.

In the first years of the war important industries were relocated in the eastern and southern areas of Germany. Latter, some of them had to be moved back again speedily, a process which necessarily resulted in reduced output. Initially such factories were moved to areas of Germany still beyond the range of bombers in 1942. For this reason it became necessary to move them again later on. In some cases the firms opposed the orders to move to new localities, desiring to preserve their factories for post-war purposes. In such cases drastic steps had to be taken.

Just as important as it was to find contiguous areas for manufacturing works was the problem of housing for the employees. Cantonment type buildings were no longer adequate for this purpose, and buildings such as schools, inns,

495 Karslruhe Document Collection: "Verlagerung der Luftwaffenindustrie" (aus Amtschefbesprechungen am 5.2.1943).

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377 and castles, which might otherwise have been used, were in increasing demand to house persons who had been bombed out of their homes.

The object in moving factories to new surface locations was to reduce the size of individual targets by means of a systematic dispersion, thereby to increase their number, and thus cause a dispersal of the attacking forces.

For Germany's air armaments it was a race for time and space, with Germany's chances of success receding, however, from month to month.

One might say that the attacks were following up the German relocation movements and striking the newly established manufacturing sites systematically and with precision

The result of these attacks was that Germany's aircraft industry was in a perpetual state of transition.

It is only natural that this constant movement had an exceptionally serious impact on manufacturing operations.[496]

~~Movement to Underground Sites~~.[497]

Really serious attempts to move aircraft industries under ground only commenced after all possibilities for their relocation above ground had been exhausted. The start was made, unfortunately only as late as in the autumn of 1943, under direct instructions from Reich Marshal Hermann Goering. In the past the only measures taken had been of a makeshift nature by movement into new surface premises designed to maintain output and to avert further

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494. For details see Karlsruhe Document Collection: "~~Luft~~schutz und Luftwaff~~enruestung~~ I und II (Die oberirdische und die unterirdische Verlagerung), Oberstlt. a.D. Greffrath, 1954.

496. See source quoted in Footnote 494, Teil I, last page.

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378 losses in manufacturing capabilities.

From the start labor shortages and inadequate transportation facilities necessitated a very careful selection of the branches of the industry which were to be relocated underground. The movement to already existing underground locations, such as mine shafts, tunnels, and the subterranean passages of old fortifications required less time than the creation of such shelters would have, and in fact even less than movement to sites where concrete protection above ground would have been necessary.

It was difficult to find a solution for the problem of camouflage during reconstruction work. The spped with wh which the work had to be carried out further complicated matters and in some cases resulted in more buildings being taken under attack than the available labor forces could manage to evacuate in time.

Fighter manufacturing installations were moved underground first.[498]

The importance attached to underground manufacturing sites is clearly revealed in passages of Global Mission, by Air Marshal H. H. Arnold, USA.[499]

497. For details see source quoted in Footnote 494, Teil II.
498. See Appendix 30 for example: Jet Aircraft Factory Kahla.
499. Karlsruhe Document Collection: "~~Unterirdische Verlag~~erung der deutschen Flugzeugindustrie," excerpts translated from Global Mission.

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A particularly impressive example of underground relocation is that of the Desdemona Factory (Werk Desdemona) of the firm of Glaukonit A. G., in Hohenems, which was moved to underground premises in three galleries, one below the other.

500. Karlsruhe Document Collection: Photstat Copy No. 4374-859 (164: Werk Desdemona--Underground Shelter.

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381 4. ~~Passive Air Defense Requirements in the Field of Above-Ground Building Construction~~.

a. ~~With a View to the Effects of Explosive Bombs~~. The sensitivity of a structure to air attack is reduced if the structure is so built that bombs striking near by or at a distance will not cause its collapse, but will cause only minor damage which can speedily be repaired. For this reason all buildings--and the stringency with which this rule was enforced depended on the importance of the building concerned--was to be so anchored in the ground that they were to a great extent proof against the effects of shifts in the ground, such as jolts, buckling, uneven settling, or sideslipping. They were to be so constructed that the supporting skeleton of upright supports roofs could not be caused to lose cohesion or weakened dangerously by pressure from any side.or direction.

The above specifications were best met in buildings constructed on a skeleton system. In this category preference should be given to the trelliswork systems in which the individual sections in themselves were highly resistant to bending even under horizontal pressures, or in which skeleton ~~XXXXXXXXXX~~ supporting frameworks or of adequate mass and bulk were so joined that the force of any horizontal pressure would be conducted from the support frame to

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381 the ground

Where there was no possibility to use the framework or trelliswork support system of construction, many possibilities existed to improve other types of structures, methods which were dealt with in the appropriate literature.

b. ~~With a View to the Effects of Incendiary Bombs~~. All structures had to be designed to prevent a quick and destructive spread of development of fires. For this purpose, every building had to have an attic above the top floor. Attics were to be easily accessible, open to vision in all parts, were to have no hidden corners, and if possible no partitions.[501] The development of heat pockets is
is best prevented by a tile roof. Specifications were also established for the degree of penetration resistance and fire resistance of roofs.

To reduce fire hazards decrees were issued containing regulations governing the construction of hard surface ceilings, the use of side rafters (Randbalken), stone atairs, stairwells, fire and other separating walls, the partitioning of attics, and the provision of water faucets.[502]

Wherever these instructions were carried out they proved sound, but in view of the large-scale attacks which took place there was no chance for them to produce any

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382 real success in closely built up town areas.

The requirements briefly sketched in the foregoing passages as applicable in the field of above-ground structures still remain valid. All that is necessary is to adapt them to meet the requirements resulting from the increased effectiveness of future weapons.

Oberregierungsrat+ Leutz of the present German Federal Ministry for Housing has formulated the requirements stated under (a) and (b), above, briefly as follows:

> What we are striving to attain is on the one hand a fireproof house, on the other hand types of buildings as proof as possible against the forces of pressure and suction. The steel-skeleton-supported concrete system of construction, for example, is very suitable for this purpose.

5. ~~Air Raid Shelter Construction~~. Protection of the civilian population against the effects of air attacks was and still is the cardinal requirement for preservation of any country's military potential. Production of any kind hinges upon the capabilities of the working population.

In total warfare practically every man has to participate in one way or another in the manufacturing and other producing

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501. "Verordnung zur Hebung der baulichen Feuersicherheit" vom 20 August 1943 (RG Bl. I, p. 497).

502. See VIII, b, below.

503. ~~"Baulicher Luftschutz,"~~ in Volume 1, ~~Schriftenreihe ueber zivilen Luftschutz~~, ~~Verlag Gasschutz und Luft~~-schutz, Koblenz, 1953, p. 98.

\+ ~~Oberregierungsrat~~=High level Government counsellor in the second ministerial grade.

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383 processes. The first responsibility was to preserve that working capacity and to to give every man the confident feeling that he and his family were being protected. This opened up a wide field of diversified activities. It was necessary to create protective facilities

(1) within the individual houses;

(2) for persons caught unawares by an air alert while away from home;

(3) within factories, installations, offices, and other working places.

The shelter, later officially called air raid shelter, had to afford protection against fragmentation, against the blast effect of high explosive bombs, and against gases.[504]

From the technical point of view, it was even possible to provide protection against all contingencies, including the effects of direct hits, However, the expenditure in funds, materials, and labor were so great that such structures could only be provided on a limited scale in bunker type shelters.[505]

384 Numerous regulations were issued dealing with the various technical and organizational problems involved in

504. "Schutzraumbau," by Regierungsbaurat Dr. Ingenieur Fromhold, in Sammelwerk Knipfer-Hempe: "Der Zivile Luftschutz," p. 318.
505. See VIII, a, cc, below.

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384 the construction of air raid shelters.[506]

The Second Decree in Implementation of the Passive Air Defense Act of 4 May 1937[+] applied to the construction of shelters in new, reconstrueted, or enlarged buildings.[507] The basic requirements were stated in the First Regulations Effectuating Paragraph 1 of the above Second Decree.[508] Supplementary to the above, the Reich Minister of Labor in turn issued explanatory and effectuating regulations within his sphere of authority.[509]

From the start it was necessary in the field of air raid shelter construction to take into account the existing shortages in certain construction materials, particularly steel. The Reich Minister for Aviation and Commander in Chief of the Air Force issued instructions on this subject in his decrees of 1 June 1937,[510] 30 November 1937,[511] and 22 July 1938.[512]

The increasing severity of the air situation and the dense massing of populations in particularly endangered areas because of the establishment of new and the relocation of existing factories in combination created practically insoluble problems in the field of air raid shelter

506. Karlsruhe Document Collection: "~~Bauwelt--Wortlautsamm~~-lungen.
507.[+] "Zweite Durchfuehrungsverordnung zum Luftschutzgesetz vom 4. Mai 1937; See Footnote 506, above, and II, d, above. Text as promulgated on 31 August 1938 RGBl. I, p. 568.
508. Footnote 506, above, for source, p.27 (RGBl. I, p. 568.
509 Ibid, p. 39 of 13 May 1937.

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384 construction. Conferences between all of the highest authorities concerned on measures which could be taken to speed up and increase the scope in the construction of shelters by means of a concentration of efforts resulted in the issue of what was called the Fuehrer Construction Program (~~Fuehrerbauprogramm~~) on 10 Oc ober 1940 in the form of a direct order from Hitler.

Among others, this order contained the following instructions:

(1) Basic directives concerning passive air defense building construction activities for protection of the civilian population. The definition of passive air defense localities in which an immediate program was to be initiated involving the following construction measures:

(a) bomb proof air raid shelters

(b) immediate emergency measures

(c) openings to be made through fire walls

(d) improvement of existing air raid shelters of all types

(e) the use of cellars in national and state owned, other public, and privately owned buildings

(f) air raid shelters for the Extended Self-Protection System; and the Factory Air Defense System at the expense of the Nation; execution of passive air defense building construction measures by the Plenipotentiary for Building Activities; the establishment of priority sequences by air district commands in agreement with the regional representatives of the Plenipotentiary for Building Activities.

(2)bDirectives to improve existing air raid shelters

510. Ibid, p. 72 ZL 5 c 9268/37
511. Ibid p. 85 ZL 5 a 11453/37
512. Ibid p. 86 ZL 5 c 13039/38.

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385 with support and advice from passive air defense construction experts and officials of the Reich Passive Air Defense Society.

(3) The role of the air district commands in directing the execution of the passive air defense construction measures ordered within the scope made possible by available labor and materials and in the proper sequence of importance.

(4) Authorization of the air district commands to take action under the Fuehrer Construction Program to improve the effectiveness of public air raid shelters in particularly endangered localities by means of dummy installations. Appeals to the public to improve existing im-

386 provized shelters independently of any other action taken.

(5) Instructions to the various local chapters of the Regional Factory Air Defense System to compile lists showing recommended sequence of priority for air raid shelter construction under the Factory Air Defense System. Final decisions to be made by the appropriate air district commands.

The plans for each individual factory or other installation were to be subject to examination by regional representatives of the Plenipotentiary for Building Avtivities in the matter of e onomy and technical standards. Construction plans and cost estimates were to be sumbitted by the management concerned. Construction to be carried out by

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386 the factory or other installation concerned.

(6) Regulations establishing the allocation of building materials for air raid shelters under the Factory Air Defense System.

(7) Directives governing the turnover of air raid shelters and other passive air defense structures by the directors of construction to the appropriate regional representatives of the Plenipotentiary for Building Activities within the scope of the Fuehrer Construction Program, to take place in two stages

(a) Preliminary acceptance

(b) Final acceptance.

(8) Instructions that crew members of ships using national waterways were also authorized to seek protection in all air raid shelters.

(9) Measures to complete air raid bunker type shelter currently under construction under authority of the "Directive for the Construction of Bomb-Proof Air Raid Shelters (~~Anweisung fuer den Bau bombensicherer LS-Raeume~~). Adaptation of plans already prepared or to be prepared for the construction of air raid shelters to meet the requirements of the Regulations for the Construction of Air Raid Shelters (~~Bestimmungen fuer den Bau von LS-Bunkern~~) as revised in July 1941.[513]

513. See VIII, a, 5, cc, (2), below.

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386 Establishment of responsibilities: the air district command involved was to be fully responsible for direction of all activities, and was to establish the priority sequences, for all passive air defense measures to be executed, in agreement with the appropriate regional representative of the Plenipotentiary for Building Activities, particularly in respect to what was to be constructed, and when and where it was to be constructed. Responsible for execution of the Fuehrer Construction Program was the Plenipotentiary for Building Activities, in Berlin this responsibility was vested in the Inspector General of Works.

In a decree dated 31 July 1941 the Reich Minister for Aviation and Commander in Chief of the Air Force ordered that emphasis was to be shifted to execution of the Fuehrer Construction Program. A second series of structures was to be undertaken in a number of particularly endangered localities at the expense of delaying passive air defense building measures in other localities which were were not so seriously threatened.

The increasing gravity of the air threat necessitated increased passive air defense measures, also in localities

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387 hitherto not covered by the Fuehrer Construction Program. The Reich Minister for Aviation and Commander in Chief of the Air Force therefore ordered by secret decree (Erlass ~~Az. 41 L 4239 Nr. 4718/43, geheim~~) dated 24 March 1943 that in addition to the Fuehrer Construction Program currently being implemented, the program was to be extended in the following points:

(a) Development and improvement of air ~~XXXXXX~~ raid shelters for the civilian population in particularly endangered areas hitherto not included in the program;

(b) Development and improvement of passive air defense installations of the various services, such as the air warning detachments, public air raid shelters, passive air defense command posts, etc.

(c) Development of the air raid shelters for civilian hospitals.

Responsibility for the direction of these measures was assigned to the various air district commands, which were to act in agreement with regional National Socialist Party Leaders (~~Gauleiter~~) and the regional representatives of the Plenipotentiary for BuildingActivities. Execution of the measures was carried out by the latter at the expense of the National Government.

Also supplementary to the expanded Fuehrer Constructio

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387 Program, orders were issued on 18 May 1943 that all military personnel of the Army, the Navy, and the Air Force present in the Zone of Interior were to be employed in the construction of air raid shelter trenches.

The same order was issued on 30 June 1943 for all personnel of the Reich Labor Service. Here again priorities for the various passive air defense localities and for the measures to be taken was established by the appropriate air district commands in agreement with the Gauleiter and regional representative of the Plenipotentiary for Building Activities.

The provisions of the original Fuehrer Construction Program applied to a total of 61 passive air defense localities. As early as in July 1941, however, developments in the air situation made it necessary to continue the measures involved and extend the provisions of the program to a second series of measures comprising an additional 56 localities in the western and central areas of Germany. Another complication was the fact that the construction of bomb-proof shelters had to be seriously curtailed because of inadequate supplies of building materials, and shortages of labor, transportation, and fuel. Further deterioration o of the air situation made it necessary to concentrate first of all on the measures to be taken in the areas of Air Dis

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388 District Commands VI and XI.

On the basis of the current status in the execution of passive air defense projects, the Chief of the Passive Air Defense Operations Staff on 18 May 1943 compiled a list establishing priorities for the various passive air defense localities (Dringlichkeitsliste der Luftschutzorte).[514] In the accompanying report he stated that neither the building materials nor the fuel supplies available were adequate for completion of the program. It also contained a recommendation that a comprehensive all-out effort should be launched, similar to that for construction of the Atlantic Wall, to complete the program for the construction of air raid shelters. Unfortunately, this recommendation was not approved.

On 19 July 1943 Under Secretary of State for Aviation and Inspector General of the Air Force made another attempt to obtain approval for increased construction. The number of persons for whom shelter was provided at the time was estimated at 20 400 000. Of these only 840 000 had bomb-proof protection, while 19 540 000 had to rely on makeshift cellar structures. Experience having shown that makeshift shelters were of questionable value anyhow, the requirement was stated to speed up the construction of bunker type shelters and above all of fragmentation proof trenches.[515]

514. Appendix 31.

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389 Difficulties were encountered throughout in all efforts to secure adequate labor forces for the construction of air raid shelters. These difficulties existed in all fields of the war endeavor, a fact clearly brought out in the documents of the Nuremburg trials.[516]

Delays occurred in all construction projects, due both to labor and raw material shortages. Non-participants in the program also caused complications by submitting unqualified recommendations to the highest authorities,which resulted in the issue of directives by Hitler concerning technical problems already solved or on the best way to solution in the appropriate research and testing stations.[517]

Records of the Central Planning Office reveal that the raw supplies and labor available in 1944 were far from adequate to meet the highly diversified requirements, and that there was no possibility to allocate sufficient to meet the needs of passive air defense.[518]

390 The experience gained in the construction of air raid shelters found expression in a compilation of directives issued in July 1955 by the present German Federal Minister for the Building of Homes (Bundesminister fuer Wohnungs-Bau). The compilation is entitled Richtlinien fuer Schutzraumbau (Directions for the Construction of Air Raid

515. Karlsruhe Document Collection ; "Luftschutz der Bevoelkerung, text of a report to Reich Marshal on 19 June 1943.

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516. Ibid : "Deckung des Bedarfs an Arbeitskraeften," from a report by Chief of Reich Chancellory Lammers on a conference with Hitler, Appendix 38.

517. Ibid: "Luftschutzbau 1941," Report to the Reich Marshal on 9 May 1941.

518. Ibid: "Luftschutzbauten 1944," from records of the Central planning Office, 5 April 1944.

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390 Shelters and was prepared in agreement with the Reich Minister for the Interior. It is organized under the following headings:

Directives for Air Raid Shelter Construction
Directives for Bunker Type Air Raid Shelter Construction
Diredtives for Shelter Tunnel Construction
Directives for Air Raid Shelter Ventillation
Directives for Sealing of Air Raid Shelter Apertures.

The directives include a profusion of sketches, diagrams and technical data and allow for the widely diversified circumstances. It is therefore unnecessary to enter into details here on the experience gained in this field.

A compilation on the funds, material,and labor expended on the various types of air raid shelters in the last phases of the war is attached to this study.[520] (sic)

aa. Shelters Constructed within Houses. Preparations for protection of the civilian population initially had to be confined to a makeshift imporvement of existing suitable space. The concentration of large bodies of people results in heavier losses during air attack. For this reason preference had to be given to the preparation of numerous small shelters rather than a few large ones. Steps had to be taken, however, that they would not be rendered

519. "Richtlinien fuer Schutzraumbauten," in a special volume of "Bundesstaatblatt 1955", Bauverlag GmbH, Wiesbaden.
520. Karlsruhe Document Collection: No. 297: "Uebersicht des Bauaufwandes fuer LS-Bauten verschiedener Konstruktion."

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390 unsafe by any possible overburden of debris or by house collapsing alongside of them.

The Temporary Local Instructions for Passive Air Defense of the Civilian Population (~~Vorlaeufige Ortsanweisung fuer den Luftschutz der Bevoelkerung~~) in Section IV contained the first regulations on this subject.

The instructions contained first directives on the selection and layout of shelters. Basically, the shelter was to consist of a number of rooms or compartments, the minimum being three, namely, the gas trap, the actual shelter, and the toilet compartment. Shelters were to be easy to find and easily accessible. If possible they were to be underground and were to have no pipelines. A brief compilation of technical specifications was published.[522]

The Ninth Decree in Implementation of the Civil Air Defense Act: Makeshift Passive Air Defense Measures in Existing Buildings (~~Behelfsmaessige Luftschutzmassnahmen in bestehenden Gebaeuden~~) provided a legal basis for action in the case of existing structures.[523]

Further directions were contained in the First Effectuating Regulations to Paragraph 1 of the Ninth Decree in Implementation of the Civil Air Defense Act (~~Erste Ausfuehrungsbestimmungen zum.....~~) and in the Second Effectuating Regulations: Regulations on Creating Openings through Walls

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391 of Existing immediately Adjacent Buildings (~~Bestimmungen ueber Mauerdurchbruechen in bestehenden, unmittelbar benachbarten Gebaeuden~~)[525] These openings proved a sound measure and in many cases made it possible to rescue the inmates trapped in a shelter.

392 Finally, the Reich Minister for Aviation and Commander in Chief of the Air Force on 6 February 1944 issued a decree under the title: Directives Governing the Nature and Scope of Support to be Given in the Preparation of Makeshift Air Raid Shelters and the Creation of Openings in Fire Walls (~~Richtlinien und Umfang des Beitragens bei der Ausfuehrung von behelfsmaessigen Luftschutzraeumen und von~~ Brandmauerdurchbruechen),[526] which was supplemented by Second Directives (~~Zweite Richtlinien~~)[527] on 26 July 1941, and a Supplementary Decree (Ergaenzungserlass) on 2 April 1942.[527]

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521. See II, c, above.

522. Footnote 485, above, and Karlsruhe Document Collection: "Bautechnischer Luftschutz (vor 1939)" by Greffrath, 1954.

523. For 31 August 1943 text see Karlsruhe Document Collection: RGBl. I. S. 522.

524. Ibid for 17 August 1939 text: RGBl. I. S. 1393.

525. Ibid for 12 March 1940 text: RGBl. I. S. 486.

527. Ibid for RGBl.Sp. 46, MBliV S. 347.

528. Ibid: for RGBl. S. 103.

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392 From the start the free initiative of the civilian population was exploited in the approach to the problem of air raid shelters.

The officials of the Reich Passive Air Defense Society a and the personnel of the self-protection system combined in contributing, outside of their other Passive Air Dfense Society and professional duties, voluntarily towards bringing the problem of construction for air raid defense closer to a solution in at least their small field. For example, the Society organized construction teams, each consisting of appropriately trained Society officials serving as a cadre of technical personnel for above and below ground construction, surveying, skilled and unskilled labor, etc., plus volunteers from the self protection system.

The duties assumed voluntarily and on an honorary basis by these teams included:

(1) The training of personnel of the Self-Protection System in the subjects of building construction, passive air defense and engineering techniques. The object was to enable the trainees to carry out certain construction projects, in particular the construction of makeshift shelters, in a manner which met technical specifications.

(2) Efforts by word and deed to enlighten the public and secure their cooperation in shelter construction.

(3) The construction and maintenance of air raid shelter and other models.

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393 These voluntary construction teams gave frequent proof of their ability to exist and of their capabilities, and up to early 1937 remained a reliable and effective instrument of the civil air defense effort. The First Effectuating Regulations to Paragraph 1 of the Second Decree in Implementation of the Civil Air Defense Act: Air Raid Shelters Regulations (~~Schutzraumbestimmungen~~), issued on 4 May 1937, ended voluntary participation in the construction of air raid shelters and made such activities compulsory.

In exceptional cases, for example where inadequate or no cellar space was available or could only be developed at disproportionately high cost or had to be newly constructed, it was permissible under certain conditions to provide shelters in the ground floor, the central parts being preferred for this purpose. Stairwells could also be taken into consideration for the purpose, the advantage here being that already existing regulations required the walls to be of masonry, strong, and proof against fire and smoke, so that only structural alterations were necessary for them to meet the technical specifications for air raid shelters. The main modifications required here were to sink the stairwell somewhat deeper, to reinforce the outer walls and improve the existing supports, and to provide a protective cover and catch ceiling. An irremediable disadvantage was, however,

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393 that such shelters provided only conditional protection against direct or near hits, and that if they were destroyed heavy casualties resulted.

There can be no doubt that hundreds of thousands of people owe their lives to the existence of air raid shelters.

It is only natural that the shelters constructed in houses could not serve their intended purpose in the case of large-scale attacks or in the event of large area fires.

394 The important requirement in such cases was to move the population out of the threatened areas as speedily as possible and as a precaution against such eventualities special public air raid shelters had to be constructed for the population of particularly endangered districts of each town.[528]

Special measures were necessary to enable persons to escape from their shelters if these collapsed or became surrounded by fire. The measures involved here were of a structural nature, and everything possible was done to take them. The important points were as follows:

bb. ~~The Establishment of Rescue Services~~.

Here, the following possibilities existed:

(1) ~~The Breaking of Openings through Party walls~~. In most cases openings into adjacent cellars proved the best emergency exits from shelters. The best solution here was found to be a series of openings

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394 providing an escape route through all party walls of an entire block of buildings. For this reason steps were taken to create more such wall openings in cellar walls wherever it was possible by this means to improve and increase the escape routes.

(2) Criss-Cross Passage System Connecting Houses underground. Wherever possible, measures had to be taken to construct such underground systems connecting various blocks of houses and thus forming a complete network of escape route with outlets, if at all possible, in open areas. Wherever the top surface of such passages was exposed to damage by falling houses, the roofs had to be adequately reinforced. The areas thus endangered was that extending as far as two-thirds of the nearest building or buildings.

(3) Underground Passages Between Houses as Air Raid Shelters. Where only unsuitable or inadequate cellar space was available for use as air raid shelters, the passages described under (2) above were to be developed as air raid shelters, which provided a possibility to improve and increase the shelter space already available. The layout of such "shelter" passages depended on local circumstances. They were to have at least one

529. See VIII, a, 5, cc, below.

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395 turning at right angles.

(4) ~~Exits Proofed against Blocking~~. Emergency exits had to be as safe as possible against the possibility of being closed by falling debris. A particularly good solution here was found to be to have the exit outside the range of debris if the house from which it led should collapse. The following spedifications applied in the construction of emergency exits of this typ type:

(a) The passage was to have at least one sharp right-angle, turning.

(b) The exit was to be safe against debris which could close it.

(c) The dimensions had to be large enough for an adult to crawl through it easily. Wherever possible it was to be large enough for an adult standing upright or stooped.

5. (5) ~~Emergency Exits -- Giving Direct Access from a Building to the Open Air~~. If it appeared necessary to increase the number of emergency exits, it was permissible to create such exits giving direct access from a cellar, and in very special cases even from the shelter itself, to the outside, provided this would not expose the shelter to the threat of blast pressure or the effects of incendiary bombs.

If necessary, steps could be taken to render already

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395 existing emergency exits safer.

396 As previously mentioned, air raid shelters constructed in cellars proved a sound solution wherever escape routes existed and could be kept open. With the increasing frequency of large-scale attacks, large area fires, and fire storms, however, cellar shelters of this type could no longer provide adequate protection in closely built up areas of cities. For this reason an entirely new concept has developed, which had its beginnings already in the last phases of the war and has become more prevalent since 1952. The basic feature of this new concept is"a complete rejection of the use of cellar space or the adaptation of such space to serve as shelters. The shelter room has now become a shelter building, literally speaking, a building standing alone, enclosed on all sides by buckle-proof highly stable walls, one might say a small shelter bunker."[530]

In view of the effectiveness of modern weapons, the cellar type of air raid shelter will still be of considerable importance in sparsely built up areas. In closely built up city areas, however, it would provide only very limited protection and would represent an added hazard for its inmates.

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530. "Der Schutzraumbau," Professor Dr. Ing. Wiendieck, in "Ziviler Luftschutz," Vol. 12/1954, Verlag Gasschutz und Luftschutz, Koblenz.

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396 cc. ~~Public Air Raid Shelters~~. Initially known as "Public Collective Air Raid Shelters (~~oeffentliche Sammel-schutzraeume~~)"[531] these were to be distributed throughout city districts in a ratio proportionate to normal and peak traffic densities. As a start, the cellars of public buildings,

396 underground tunnels, storage cellars, and the cellars of large private dwellings were taken into consideration for the purpose. Where such spaces were not available, special shelters were constructed, primarily in passive air defense localities of Category I. The technical specifications corresponded to those for other air raid shelters.

In the beginnig these shelters were by no means bomb proof, and provided protection only against near hits, the exception being where they had a natural covering of earth.

1. Bunker Type Air Raid Shelters. With the increasing caliber of the bombs used, more emphasis was placed on the construction of bomb proof shelters. The decrees and directives issued on this subject were consolidated in the compilation "Regulations for the Construction of Bunker Type Air Raid Shelters (~~Bestimmungen fuer den Bau von Luftschutz-~~Bunkern)"[432]

Volume I of the compilation was organized under the headings

Background, Planning, and Layout

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397 Volume II under the heading: Structural Development

Volume III " " " Ventillation, heating, cooling.

" IV " " " Water supplies and drainage.

It is not possible to enter into details here, but a brief summary of the more important regulations will be found in the Karlsruhe Document Collection.[533]

In efforts to exploit all possibilities to provide protection for the civilian population, military buildings were also used. Thus, large shelters with separate entrances were built into the AA gun towers in Berlin for use by the public. These towers also contained medical stations in which even complicated surgery could be carried out under bomb proof protection.

The following experience was gathered on the subject of bunker type air raid shelters:

The number of such shelters available in Germany was naturally nowhere near adequate. They were established primarily in residential areas which had no cellars at all or cellars which were not suitable for improvement as shelters.

Care had to be exercised to select a building site for the bunker at a safe distance from high houses.

A large fire surrounding a bunker seriously endangers proper ventillation. In one such case, that of a large-scale attack against Hagen, in Westphalia, a shortage of oxygen occurred and th

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398 occurred and the air sucked in through the ventillators was considerably overheated.[534]

Broad and easily accessible ascents and descents must be provided, otherwise injuries might easily occur during crowding. Therefore, it might be wise to examine the advisability of providing covered approaches to the shelters.

Generally speaking, bunkersware built in the cube form. In a few case the heavier bomb calibers used by the enemy later in the war pierced the roofs of some bunkers. This was because the bunkers erected during the first few years of the construction program were not designed for resistance against such heavy calibers. In part it was also due to the necessity to use steel sparingly in the construction.

In all cases conically shaped shelter bunkers proved adequately resistant. An example here is the Winkel design. In the air attack which resulted in complete destruction of the gasoline works of Scholven-Buer, for example, the only structure which escaped destruction was the air shelter tower.[535]

It is a categorical necessity for each shelter bunker to have its own independently operated electricity system for lighting purposes.

During the initial stages, shelter bunkers were subdivided into individual compartments, each with sleeping

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399 spaces for six persons, and the local passive air defense chief specified which families and persons were authorized to use the nearest bunker, and were allocated their specific compartment there.[536] This arrangement had to be discontinued when the number of persons seeking shelter became too great after commencement of the large-scale attacks. Special arrangements had to be made for administration in each bunker, and separately for the medical compartments, as well as for the guarding and servicing activities.

A shelter bunker warden was appointed by the local passive air defense chief for each bunker with the privileges and missions of a passive air defense warden as defined by the articles of the Civil Air Defense Act. The warden assigned the various assistant personnel and messengers their duties, and was responsible for the maintenance of law and order during entrance to, use, and exit from the bunker.

The operational personnel by whom he was assisted constituted a shelter guard group with the mission of damage control action in houses in the close vicinity.

The local passive air defense chief also appointed a bunker administrator, who was responsible for the structural

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400 maintenance, servicing, and supervision of the bunker, including all equipment.

2. Air Raid Shelter Tunnels. With the increasing ffequency and size of air attacks it became increasingly necessary to give the development of quickly available even if only conditionally safe shelters preference over the development of completely safe shelters, a matter for the future, but at the same time to exploit all means for the development of the conditionally safe type. The most economic form of protection was undoubtedly that afforded by tunnels and shelter trenches. The factor in favor of tunnels was the complete protection they provided, that in favor of shelter trenches the short time required to provide at least conditional protection.

No standards were available to conjecture the scope of destruction which air warfare would cause, so that the problem of tunnel shelters was not given enough consideration prior to the war. Some expe rience was available only in mining regions, where tunnel shelters were prepared. In like manner existing natural caves were also exploited for this purposes, although there was no large-scale planning in this field.

"Shelter Tunnels. provide the greatest protection. the costs are estimated at approximately DM 400, or

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531. See Section VI: "Schutzraeume," of "Vorlaeufige Ortsanweisung fuer den Luftschutz der Zivilbevoelkerung, p. 18.

532. For July 1941 text see Karlsruhe Document Collection.

533. Karlsruhe Document Collection: "Bombensichere Luftschutzbauten (Luftschutzbunker), by Hans Worringen, 1955.

534. See pp. 90-91 of source quoted in Footnote 411.

535. Air Photo Scholven-Buer.

536. Karlsruhe Document Collection: "Bombensichere Luftschutzbauten fuer die Bevoelkerung," Rd.Erl.R.d.L.u.Ob.d.L., 31 May 1941 in "Luftschutzrecht," by Darsow-Fokken, 31 August 1943 Edition.

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400 roughly 150 Dollars per person to be protected. In contrast with other types of shelters the holding capacity is practically unlimited. Under a long-range plan a shelter tunnel can be prepared and can later be extended without in any wa y detracting from the protective capabilities of the initially prepared sections."[537]

Possibilities exist in almost all parts of Germany for the development of shelter tunnels. Particularly favorable conditions exist where there are mountains with solid but easily cut rock, as is the case in the Saar region. There air raid shelters were in existence since 1941, which were so large that in many cases the whole population of a locality could find protection in them, and the total holding capacity afforded complete protection for many hundreds of thousands of persons.

Similar geological conditions exist in other parts of Germany. One of the fortunate peculiarities of Germany is that mountains are to be found practically everywhere, with the exception of the northern parts and the northeastern regions, where the air threat was relatively small. In all of these mountain areas it was possible to to create shelter tunnels in solid rock.

The failure to create shelter tunnels on a much larger scale than actually took place in suitable areas right at

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401 the beginning of air warfare was due in reality to only one reason. This reason was a general lack of familiarity with mountains and the tunneling processes. The "Regulations for the construction of Shelter Tunnels (Bestimmungen fuer den Bau von LS-Stollenanlagen)"[538] in essence stated as follows:

For reasons of safety as many exits as possible were to be provided, so that one large tunnel project was to be given preference over a number of small ones.

Shelter tunnels were to consist of the following subdivisions: Entrances, gas locks, the actual shelter spaces, and machine spaces. Entrances: Each shelter tunnel should have at least three entrances, each with a gas lock. The entrances were to be at least 33 yards apart.

The sites for shelter tunnels were to be so selected that there would be a bomb-proof cover.

If at all possible, water should be laid on from the public water mains.

If there was not sufficient slope for natural drainage, for example in deep tunnels, precautions were to be taken against the possibility of the tunnel being flooded if the water pipes were destroyed or damaged. Special precautionary measures had to be taken against this eventuality.

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402 According to local conditions, the water supply could in some cases be insured by means of wells. As a precaution against ppssible failure of other water supplies, an emergency supply source under bomb'proof shelter was to be provided in the form of wells or storage reservoirs.

Electricity was to be taken from the public network, if possible from a number of separate points and from at least two separate supply stations. Where two electricity supply networks existed from separate sources, the second network was to be used for the second source . Regulations provided for the installation of a power plant for use in emergencies. If there was no possibility to procure a power plant, emergency lighting was to be provided by means of electric torches, candles, etc.

403 Many of the mistakes made during the first years of warfare in the construction of air raid shelter tunnels were due to a false conception of their purpose. The construction of shelter tunnels was not a mining project but a construction project. It was naturally not possible to dispense with the advice of mining personnel.

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537. "Der Schutzraumbau," Professor Dr. Ing. Wiendieck, p. 303, in "Ziviler Luftschutz," Vol. 12, 1954, Verlag Gasschutz und Luftschutz, Koblenz.

538. Karlsruhe Document Collection: "Bestimmungen fuer den Bau von LS-Stollenanlagen, Fassung Juli 1943.

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403 The problem most discussed in public was that of the minimum thickness of cover required to prevent penetration by bombs. Therefore it was one of the first on which definitive regulations were issued. Unfortunately it was necessary in many cases to depart from the prescribed minimum thickness of cover, since the depth at which a tunnel could be driven depended largely on the local geological conditions.

Within cities the construction of tunnel shelters has significant advantages over the construction of bunker type shelters. Quite apart from the factor of easier construction, it requires considerably smaller expenditures in raw materials and offers the possibility to economize in cement and gravel, and almost completely do without iron or steel and pit timber. The construction does not place as heavy a burden on the transportation system as does the construction of bunkers. In the third and fourth years of warfare these advantages were significant enough to recommend promotion of the program to build tunnel type shelters in preference to other types.

~~The Construction of Tunnel Type Shelters for Industrial Concerns~~. The passive air defense requirements here could naturally only be met to the extent made possible by the available building capacities, and took the form of protection of personnel and industrial installations against bomb fragmentation, falling debris from buildings, and incendiary bombs,

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403 and carefully planned camouflage of all newly established installations.

404 To the disadvantage in the solution that these installations were only imperfectly protected against air attace, must be added the the time always lost before newly established installations can commence producing.

The disadvantages of above-ground relocation (time and building requirements and lost output) had led, even at a time when opportunities still existed for precautionary measures, to relocations in underground premises. This applied for example to the bomb-proof construction of a number of underground electric power stations, in particular the operating and machinery installations involved at hydroelectric works, where these installations were in some cases built into the walls of dams and in other cases into mountain sides. The advantages of installations thus absolutely safe against the effects of air attack were obvious. There was no fear of any interruption by air reports or air alerts and no wastage due to interruption of manufacturing or other processes. Work could proceed day and night, and what was most important, there was no fear of the necessary installations and so forth being destroyed.

Isolated protests were made ahgainst the fact that the

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405 employees would have to work underground. Undesireable as this seemed from the humanitarian and health viewpoint, the primary consideration during war was to have safety and preservation of the armament industry. Technological facilities, which permitted proper ventillation, air conditioning, and neon lighting made it possible to provide safer and more healthy working conditions than were enjoyed by millions of miners.

By 1943 the following experience was available on the subject of underground sites in tunnels:

(1) The funds required to prepare manufacturing sites in bomb-proof tunnels were barely higher than those for other relocations, the expenditure in controlled building materials in short supply were lower, and the overall expenditures for a relocation were barely higher.

(2) The time required for construction could be measured in weeks and was less than that for a corresponding aboveground building, even if the latter was only of a temporary nature.

(3) Work could commence at any time on the construction and could continue throughout the winter and practically without interference by enemy action.

The establishment of industrial installations in tunnels naturally also had disadvantages, but these were usually

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405 negligible. Moisture was generally considered the most adverse factor. The moisture in shelter tunnels was not only unpleasant for those employed or seeking shelter there, but also caused deterioration of the equipment and machinery, and so forth. Countermeasures therefore presented a serious problem of general interest.

The problem of shelter tunnels is dealt with copiously in present day professional literature.[539] The points of a technical nature dealt with are:

(1) Shelter space and roof thickness.

(2) Planning and execution of tunnel construction, and the necessary rescue or medical, machine, prewarming, and other separate spaces.

(3) The construction of concrete tunnels, using rigid and flexible steel arches.

(4) Construction of approach shafts to deep tunnels.

(5) The outfitting of shelter tunnels.

A comparison of the advantages and disadvantages of the various types of shelters shows that shelter tunnels have the highest coefficient of safety at a relatively low cost.

3. Covered ~~Air Shelter Trenches~~. The increasingly serious shortages in building machinery, materials, and labor gave added significance to covered shelter trenches, since these could be constructed with the least expenditure.

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406 The Reich Minister for Aviation and Commander in Chief of the Air Force, through Air Force Inspectorate 13, issued instructions on the subject in "Regulations for the Construction of Air Shelter Trenches (Bestimmungen fuer den Bau von LS-Deckungsgraeben), the last revised edition of which appeared in March 1943.[540] It had been found very soon that covered shelter trenches provided particularly effective protection if they were constructed in accordance with regulations. A particularly practical and time saving method was the use of prefabricated sections of reinforced steel. The public were called upon to assist in the construction.

The construction of such shelter trenches was prohibited in debris-endangered areas.[541] In cases where this was unavoidable, roof reinforcements had to be built in.

An important consideration was the proper placing of entrances and emergency exits, and the use of two layers of bricks between the sand cover was found highly effective.

Heating and lighting presented particular problems in covered shelter trenches. The use of electricity as a rule was intended for lighting, and the fact that no chemical weapons were used in the war made it possible to heat by

539. "Der Schutzstollen und die verschiedenen Arten seines Ausbaus," Diplom Bergingenieur Frity Ruhe, Duisburg, in "Ziviler Luftschutz," Volume 10/1955, Verlag Gasschutz und Luftschutz," Koblenz.

541. Karlsruhe Document Collection: Photostat copy of "Bestimmungen fuer den Bau von LS-Deckungsgraeben, Fassung März 1943.

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407 A large share of the mission of constructing covered air shelter trenches was assigned to Organisation Todt, a paramilitary constructional engineering organization . This orgainzation had received instructions to design and develop various types of shelters.

On the basis of experience gained on all front, Organisation Todt published pamphlets on the subject, which gave diredtions for use in practice. The first such pamphlet published under the title "Covered Air Shelter Trenches (Luftschutzdeckungsgraben)[542] contains a profusion of examples, together with illustrations and measures.

Before the experience gained in large-scale attacks brought the problem of covered shelter trenches into the foreground, such trenches had served solely as a substitute for non-existent or inadequately large standard air raid shelters. In all areas where inadequate or no cellar space was available, or where the cellars were not deep enough for the construction of shelters, the practice had been to construct covered trenches, the requirement being that they were to provide protection equal to that of the normal shelters. This required quite considerable construction expenditures. With the increasing frequency of large-scale at-

541. See VIII, a, 5, bb, below.
542. Karlsruhe Document Collection: Photostat copy of "OT-Luftschutzbauten--LS-Deckungsgraben."

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407 attacks against cities and closely populated areas, such as cantonment camps, the practice became increasingly general to regard such trenches as a substitute for normal air raid shelters which had become unusable. This circumstance vigorously promoted the construction of such trenches.

The existing regulations on the subject required a highly perfected structure, which presupposed the availability of adequate time, personnel, and materials for the purpose. The growing frequency of continuous heavy attacks, however, made the speedy construction a paramount necessity, and the seriously critical personnel and materials supply situation resulted in the use of expedients to the limit of prudence.

408 It was a logical requirement that even a makeshift covered shelter trench had to provide its occupants with what its name implied, shelter and protection. Therefore, even such trenches had to meet certain standards of suitability, which may be formulated approximately as follows:

(1) The shelter trench had to be at a safe distance from buildings

(2) It had to be easily accessible

(3) It had to be adequately large.

The requirement of safe distance was met if the trench was so far from any buildings that it could not be endangered by falling debris or fire from those building if they were struck by bombs. The law prescribed a minimum distance of

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408 equal to at least two-thirds of the height of the nearest building.

The requirement of easy accessibility was met if the trench was not too far from the living quarters of those who would use them, and if the approach to it was free of fences or other obstacles, on condition that it could be approacded from various directions, and had the largest possible number of entrances.

There can be no doubt that a trench system consisting of a number of separate sections was preferable to a system of only one trench with few entrances. The possibility to enter the trench by a large number of entrances averted the danger of massing and delays, particularly when the trench was to be used at night.

The question of whether open or covered trenches were better was decided beyond argument by experience gained in large-scale attacks in favor of the covered type, since the roof provided protection not only against fragments from antiaircraft shells, but also against flying burning debris from large fires, and against inclement weather.

However, the necessity for speedy construction, shortages of material, and other circumstances in many cases made it necessary to first do without any cover. In other cases

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409 the trench was given a roof of boles covered with a layer of earth; the elasticity of such roofs made them relatively resistant to penetration. In still other cases, the trenches remained open in parts to enable occupants to keep nearby houses under observation so that they could take immediate action in the event of any of the houses being struck by incendiary bombs.

The experience gained in years of warfare on the effectiveness of shelter trenches against the weapons used in air attacks proved time and again that they afforded a high degree of protection.

On the basis of the latest experience, the Reich Minister for Aviation and Commander in Chief of the Air Force, through Air Force Inspectorate 13, in April 1944 published certain modifications of the existing regulations, roughly as follows:

> Newly developed tactics of air attack, particularly the frequently employed method of simultaneous mass bomb release (~~Teppichwurf~~) have greatly increased the probability of hits with in an area under attack. This has also increased the probability of hits on air shelter trenches. In planning shelter trenches, provisions must therefore be made to spread the persons seeking shelter over a large area by keeping the individual parts of a trench system as far apart as possible, each part if

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410 possible to contain not more than fifty persons.

In the matter of structure, the prefabricated steel reinforced sections for trench construction have proved superior to other methods of construction.

410 Timber construction has also proved an effective protection, particularly where nailed plank frames and fascine revetments are used.

Another important factor to improve the protective quality of shelter trenches is to have them if at all possible completely below the natural surface of the ground, and to have them in ground as level as possible, with a grade of at most 1:2.

So much for the supplementary regulations issued by the Reich Minister for Aviation and Commander in Chief of the Air Force on 28 April 1944.

The experiences of war proved the usefulness of the most simple and oldest type of air raid shelter, the shelter trench, in every respect.

6. ~~Protection against Bomb Fragments~~. From the start the matter of providing protection against bomb fragments was one of the important missions in structure for air shelter The necessary regulations on this subject were issued by the Reich Minister for Aviation and Commander in Chief of

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410 the Air Force, through Air Force Inspectorate 13. Together with construction drawings these regulations dealt with the following subjects:

Bomb-fragment-proof walls of buildings and selfsupporting bomb-fragment-proof walls.

Measures to render the walls of existing buildings proof against bomb fragments

Safety devices for wall openings

Safety devices for emergency exits

Makeshift protection against bomb fragments.

The subject of protection against bomb fragmentation gained steadily in importance throughout the war. Protection had to be provided to preserve stationary cultural monuments which could not be removed for safekeeping to less endangered areas. In the case of historical building and monuments it was usually possible to provide adequate protection by means of sand bags or a protective scantling, measures which were also taken, incidentally, under orders from German authorities to protect cultural monuments in the German-occupied territories. Furthermore, protection was essential for humans, for manufacturing and other installations, and for machinery. A legal basis for all necessary measures in this field was also provided in the Civil Air Defense Act and the various decrees implementing that act.[544]

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411 No generally valid statement can be made on the best and most practicable methods to provide protection against bomb fragmentation under varying circumstances. Under the German system such measures were adapted currently to the latest experience and local conditions, and had to keep pace with the development of the weapons used by the enemy in air attacks.

In the field of structural protection, for example, the increasing use of heavy and superheavy bombs created the necessity for protection not only against bomb fragmentation but also against the forces of air pressure.

Many measures considered adequate when the war commenced had to be improved during the war.

In constructing work for protection against bomb fragmentation, preference shifted steadily in the direction of permanent structures. The temporary structures used at the beginning of the war because of the necessity for speed, and because of the lack of building materials and experience, were generally avoided later in the war. Structures of the temporary type, which became damaged and required repair because of exposure to weather as time passed were replaced by permanent type structures.

The best expedient for protection was a ~~covering~~ revetment of firmly tamped sand or soil with a thickness of approximately 4 feet. This method produced good results at airfields, where

545. ~~See II~~, d, above.

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412 it was used to protect machinery installed in the open.

In both large and small industrial installations the subject of protection against bomb fragmentation grew steadily in importance. On the basis of the directives issued by the Reich Minister for Aviation and Commander in Chief of the Air Force through Air Force Inspectorate 13 and on experience reports received, the Board of Industries published regular bulletins on the subject together with many illustrations and much technical data.[545]

The problem of what materials to use was decided from case to case according to what was to be protected. The following are the methods used which wartime experience proved to be sound.

The permanent methods used included the use of steel reinforced concrete, ordinary concrete, brickwork,

Temporary methods included the use of soil, sand, gravel, and crushed rock.

(1) Brick masonry provided particularly effective protection and proved suitable for most purposes. In contrast with other types of building materials, bricks were relatively easy to obtain throughout the war. Brick walls could be used in all cases where there was no need for the occasional temporary removal of the protection for

545. For an example see Karlsruhe Document Collection: Photostat copy of "Schutzmassnahmen ausserhalb der Gebaeude."

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412 repair and maintenance work on machinery, where the walls could remain in place without any serious disadvantages after the war, as was the case with separating walls, window protection in yards, bricked-in windows, etc.

(2) Dry-Stacked Brick Walls. These were walls of unmorticed bricks. For protection against bomb fragments they were as effective as morticed walls, against blast effect they even had advantages because of their greater elasticity. They could be built speedily anywhere, could be removed just as speedily to facilitate repair work, and then just as speedily replaced. Walls of this type were found to give excellent protection even against bombs exploding in the immediate vicinity.

Brick walls of this type proved satisfactory wherever temporary removal of the protection might become necessary, and where only temporary protection was needed. They required no supports up to a height of two meters.

(3) Concrete and Steel-Reinforced Concrete. Walls of this type, if built in the minimum thickness for protection against bomb fragments were not as resistant against blast force as dry-stacked brick walls, since they lacked elasticity. Because of their large rigid surfaces and relative thinness the danger existed that they would be blown in by bomb blast pressure and might damage the object they

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413 were to protect. Concrete walls erected to serve as protection against bomb fragments needed adequate supports.

(4) The use of prefabricated concrete wall sections proved more practicable in industrial works than continuous walls. Whenever the necessity arose for repairs to the machinery protected, the wall sections could be lifted out separately by a crane. The sections had to be wide enough to stand firmly and it was found wiser not to anchor them in the ground.

414 (5) Iron was found to be less effective than had been assumed at the beginning of the war. Wooden structures also were to be used only in exceptional circumstances, since walls consisting exclusively of timber afforded little protection, and since the timber first had to be rendered fire-proof.

All windows and doorways to premises in which there were humans or machinery had to be secured against bomb fragments. If protective walls were erected inside a building, regulations required that they must be securely anchored or supported to prevent their being blown in by blast pressure. The bomb fragment protection measures were not to interfere with the proper ventillation of the premises.

Emergency exits through the outer walls of buildings had to have protection by fragment proof walls.

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414 No matter what the type of an interior, whether it was an air raid shelter, a machine house, an observation post, or any other structure, it could only be considered secure against bomb fragmentation if all apertures were so secured that fragments from bombs bursting outside could not enter, and if the walls were strong enough to insure that fragments could not pierce through them. With the increasing blast and fragmentation force of bombs used by the enemy, the strength and resistance of all anti-fragment devices had to be increased, and the general public also realized the necessity to carry out the necessary measures and to improve existing structures.

Everybody was allowed the widest possible scope of free action in the field of fragment protection. Experienc reports by the Reich Minister for Aviation and Commander in Chief of the Air Force currently disseminated the latest experience in the form of instructions and directives. The passive air defense staff sections of the various air district commands continuously inspected the measures taken in accordance with these reports, offered suggestions, and insured proper execution of all required

415 measures, particularly in the case of militarily important industrial installations. Withthe exception of the cases

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415 of total destruction through large-scale attacks, this made it possible to maintain current industrial output at a remarkably high level.

7. Special Passive Air Defense Regulations Governing the Construction of Military Installations, Military and Other Hospitals, and Sanatoriums. In the case of all military installations with the exception of hospitals, construction was subject to the requirements stated in Air Field Manual L. Dv. 410/6.[546]

In the case of hospitals, construction was subject to the requirements stated in a general decree by the Reich Minister for Aviation and Commander in Chief of the Air Force, through Air Force Inspectorate 13, on 12 June 1942 (Rd. Erl. d. R. d. L. u. Ob. d. L.--L. In 14, letzte Fassung von 12. 6. 1942).[547] In all other respects the regulations contained in Air Field Manual L. Dv. 410/7 applied not only to military hospitals, but also to all general and private hospitals, Sanatoriums and similar institutions.[548]

The individual structural measures taken were to be adapted to local circumstances, and the purpose, significance, size, and location of the institution involved.

546. Karlsruhe Document Collection:"L.Dv.410/6 "Baulicher Luftschutz in Wehrmachtanlagen (ausser Lazaretten)."
547. Ibid: "Luftschutzmassnahmen in Krankenanstalten, Rd. Erl. d. R. d. L. u. Ob. d. L.--L. In. 14, v. 12. 6. 1942, in Teetsammlung "Luftschutzrecht" von Darsow-Fokken.
548. Ibid: L. Dv. 410/7:"Baulicher Luftschutz in Lazaretten, Krankenhaeusern, Heil- und Pflegeanstalten."

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415 Establishment of New Military and Other Hospitals, Sanatoriums, and Other Similar Institutions.

The proper location of all institutions serving the health of the Nation was a matter of extreme importance for the maintenance of the powers of resistance of the population to air attacks. In selecting a site for a new institution consideration therefore had to be given not only to the requirements of hygiene, and to necessity for natural surroundings wh ich would promote recovery of the patients, but also to the air threat.

The following directives governed the selection of sites for the establishment of new institutions:

(a) The existing directives governing all planning for building construction to meet the passive air defense requirements.[549]

(b) The existing passive air defense regulations and directives governing building construction in town developments.

The above directives prohibited the establishment of health institutions in areas seriously exposed to air threat. Building sites far removed from built up areas; agricultrual regions; and forestry sections not intended for future use as residential, settlement, or industrial areas, were considered particularly suitable for hospitals

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416 and similar institutions. Difficulties which might be encountered in such areas because of unfavorable traffic and supply facilities had to be accepted as an unavoidable disadvantage.

In order to insure proper site selection, the appropriate local authorities and the appropriate air district command were to be consulted before planning was initiated.

Civilian hospitals and similar institutions were not to contain more than 600 beds, military hospitals not more than 450. Therefore, a number of institutions not exceeding these sizes and separately located were to be given preference over larger institutions to be erected on one single site.

417 The smaller the size of the individual buildings making up an institution, and the wider the spacing between the individual installations, the lower was the sensitivity of the overall institution to air attack. The individual buildings were not to have more than two or at the most three floors. The use of higher buildings was prohibited.

For organizational and functional reasons it was most practicable to have the necessary air raid shelters for the staff and patients, as well as for certain tasks, within the buildings. The rules applied here were those con-

549. See VIII, a, 1, above.
550. See VIII, a, 2, above.

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417 contained in the First Effecutuating Regulations to Paragraph 1 of the Second Decree in Implementation of the Civil Air Defense Act (~~Erste Ausfuehrungsbestimmungen zu Paragraph 1 der Zweiten Durchfuehrungsverordnung zum~~ Luftschutzgesetz (~~-~~Schutzraumbestimmungen) Issued by the Minister of Labor in agreement with the Reich Minister for Aviation and Commander in Chief of the Air Force on 4 May 1937.[551]

Air raid shelter space was to be provided

(a) for all personnel employed in the institution

(b) for all patients or other persons needing care, space requirements here to be established on the basis of the average number of patients during peace, and to include not only bed patients, but also convalescents

(c) for certain activities, so that these could continue even during an air attack (for example, a surgery theater where emergency surgery could be carried out, a first aid room, and a tea kitchen).

Premises used for the storage of medical supplies, bandages, and food, etc., were also to be rendered gas, fragment, and debris proof. Air raid shelters were to be provided in the cellars for all personnel and ambulant patients. Efforts were to be made to also have the shelters

418 for bed patients and their nurses in the cellars. If this was not possible, suitable space was to be prepared on the ground floor, particularly in middle rooms. In all

552. See ~~XXXXX, b, below~~ II,d, and VIII, a, 5, above.

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418 cases separate shelters were to be provided for patients with infectious diseases.

In all general respects the execution of passive air defense structures was subject to the general regulations on this subject and the provisions for fire prevention.[552]

If at all possible water, gas, and electricity were to be laid on from more than one soutce each, and in all three cases provisions had to be made to have sources available independent of outside supplies. Measures were also to be taken to insure that the sterilizing installations and kitchens of any institution could be maintained in operation even if gas and electricity supplies failed completely

All pipelines and cables were to be easily accessible and were not to be attached to outer walls. Suitable colors of all pipelines and shut-off valves and wires and main switches. or directing signs were to facilitate their finding. Where they passed through walls, protection had to be provided insuring that they would not be damaged if the walls were shaken. All pipelines and wires were to be in a continuous ring system to insure quick repair and a quick resumption of supplies by cutting out damaged sections when necessary.

Camouflage and blackout measures were required in accordance with the existing regulations.

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552. See VIII, b, below.

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419 Existing Institutions (In old Buildings). In the case of already existing military and civilian hospitals, sanatoriums, etc., the question was to be examined of whether their location or their proximity to other installations implied an exposure to air threat that would necessitate their evacuation if a state of passive air defense were proclaimed. Under no circumstances were institutions thus exposed to the hazards of air warfare, or close to installations likely to come under attack, to be expanded. The general tendency was to be to reduce their operations gradually.

Any reconstruction or extension of an existing institution which could be approved from the view point of passive air defense was to be accompanied by improved general passive air defense conditions in the institution.

The regulations governing the provision of air raid shelters in institutions to be newly established were to apply in equal measure to existing institutions. Cellar space which was used in times of peace for other purposes was to be developed to provide air raid shelters.

If there was no possibility to provide adequate air raid shelters in the cellars or ground floor of the buildings, shelters were to be built as separate structures outside of the buildings. The plans, specifications, and execution of such structures was to meet the standards regquir-

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419 required in the "Air Raid Shelter Regulations (~~Schutzraumbe-~~ stimmungen).[553]" Separate air raid shelter structures were to be given a covering of earth to protect them against bomb fragments.

The measures outlined above produced good results. With the growing size of large-scale attacks against German towns it became necessary during the war to move hospitals out of towns. In the future measures of this type will have to be prepared well ahead of time, since a relocation of institutions of this type cannot be improvized.

b. ~~Fire Prevention in Passive Air Defense~~. It was to be assumed that incendiary bombs would be used in any coming war. This made it necessary not only to prepare for firefighting action[554] but also for fire prevention on a large scale.

The measures introduced were designed to

"....reduce the hazards of initial conflagration,

"to restrict any fires which might occur to their point of origin

"and to prevent the development of catastrophically large fires."[555]

1. ~~Fire Prevention~~. The first point here was to improve the fire resistance of the roofs of existing buildings and to establish appropriate requirements in this respect for new buildings or extensions to existing buildings.

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420 Certain means and measures of fire prevention were given specific approval by the Reich Institute of the Air Force for Passive Air Defense.[556] A decree issued on 13 May 1943 concerning "The Treatment of Buildings with Fire Repellants (~~Feuerschutzmittelbehandlung von Gebaeuden~~)[557] ordered supplementary to existing regulations that the requirement to treat all timber used in building with a fire repellant was now to be extended to the whole of Germany. At the same time a list was published of those passive air defense localities, together with an order of sequence, which were to be given priority in the application of these measures. At the intermediate level the officers commanding the various air district commands, acting in agreement with the Party Regional Leader (Gauleiter), established these priority sequences. The Reich Commander in Chief of the SS and Chief of German Police had overall technical responsibility for execution of the required measures. Local responsibility rested with the local passive air defense chiefs, who was authoriyed under Paragraph 7 of the First Decree in Implementation of the Civil Air Defense Act to order by means of police statutes that houseowners were required to treat all flammable parts of houses with a fire repellent in accordance with his instructions or to permit such treatment.

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421 One indispensable condition for successful fireproofing was to first clear all attics. The Third Decree in Implementation of the Civil Air Defense Act[558], known as the Lumber Clearance Decree, required that particularly flammable parts of buildings were not to be used for

(1) the storage of lumber

(2) the accumulation of discarded articles in excessive quantities and contrary to fire safety requirements

(3) the storage of articles which could be stored elsewhere or which were not easily portable.

The requirements of the decree were later extended to include the removal of the lattice-work rooms so frequently found in attics. This made all parts of the attic easily accessible, so that it was possible to extinguish fires caused by incendiary bombs before they could spread.

There can be no doubt whatever that the removal of rubble was a wise measure, since the reduced quantities of flammable

553. See VIII, a, 5, above.
554. See IV, b, 1, above
555. "Vorbeugender Brandschutz," Regierungsbaurat Dr. Schaefer, in Knipfer-Hampe: "Der zivile Luftschutz."
556. See III, g, above.
557. In Karlsruhe Document Commection.
558. See II, d, above.

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422 material reduced the intensity of any fires which might occur.

Far too little importance was attached in former times to the proper construction of fire walls. Later investigations showed that, although many houses had the specified fire walls, many of these walls had openings which were not properly sealed or protected.

An analysis of air photos showed that, in contrast with the scenes of large area fires in Hamburg, the bomb striken areas in Berlin were honeycombed with fire walls. These prevented the quick spr spread of individual fires to combine and form large area fires. This was why Berlin did not burn down as readily as other cities.

German opinions also are that properly constructed fire walls must be considered to afford a high degree of protection, which in numerous cases prevented the spread of fires. In cases, however, where the heat engendered by a fire storm surpassed all concepts, even the properly constructed fire wall was ineffective.

559. See ~~Karlsruhe Documentation~~ p. 6 of source quoted in Footnote 563

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423 Bare terrain, wide streets, rivers, or canals were frequently the only barriers capable of halting a spreading fire. In future it is therefore of the utmost importance to insure wide spacing in all residential areas.[560]

The lack of fire barriers of the above types in old-style cities had fateful results. One example here is Hamburg,[561] another is Cologne,[562] In both of these cities the lack of any such fire breaks made it completely impossible to prevent the development of large area fires and fire storms.

Acting on the above considerations, the Reich Minister for Aviation and Commander in Chief of the Air Force ordered that fire breaks were to be created by blasting in the densely built up areas of old cities. However, the impact of this measure was such that it could only be carried out in a few cases because of psychological reasons. Nuremburg is a classical example of a city where the measure was not carried out, an omission which

560. See VIII, above.
561. Report by Colonel Pidoll: see Footnote 441, above.
562. Karlsruhe Document Collection: "~~Koeln im Luftkrieg 1939~~-1945," in "Statistische Mitteilungen der Stadt Koeln, 9. Jahrgang, 1954, Heft 2.

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423 resulted in the complete destruction of the old sections of the city.

Out of the numerous publications on this subject, some of them impressively illustrated, attention is drawn in particular to the following two articles in the VFDB Journal:

"Forschung und Technik im Brandschutz, 1. Jahrgang"

Volume 1, June 1952: "Flaechenbraende und Feuerstuerme," by Oberbrandrat Diplomingenieur H. Brunswig, and

Volume 2, August 1942: "Brandschutz im Luftschutz," by Diplomingenieur Schmitt.[563]

A matter of decisive importance for all firefighting action was the availability of an alternate and independent supply of water.

424 Experience in air warfare vindicated to a degree which could not have been anticipated or conceived the soudness of the directives issued as early as in 1936 by the Reich Minister for Aviation and Commander in Chief of the Air Force to insure adequate water supplies for passive air defense purposes. The

563. Karlsruhe Document Collection.

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424 categoric necessity for a second source of water independent of the central mains became particularly evident during large scale attacks.

The constructional and organizationsl measures which proved necessary to protect the central water supply system will not be dealt with here. It is due to the fact that these measures were carried out on a large scale, and in particular to the quick action taken by the construction and repair teams held ready for any emergency, that the central water supply system remained in service in many attacks. However, cases occurred in which the system failed completely, so far as requirements for firefighting were concerned, immediately after the first phase of an attack. As a rule this was due to certain pipes in the whole system being broken. In some cases high explosive bombs struck sections of the water mains or exploded in the immediate vicinity and caused the entire system to drain out. In other cases extensive fires destroyed the terminal points of pipes within buildings,

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424 where the fires still burning and the heaps of rubble prevented prompt repairs to the pipe systems.

In such cases firefighting action hinged entirely on the available water sources independent of the main supply system. The directives issued by the Reich Minister for Aviation and Commander in Chief of the Air Force anticipated the occurrence of such situations and required in good time that the availability of alternate water supplies was to be insured through a complete exploitation of open watercourses, etc., and subsoil water supplies, as well as through the construction of water containers.

Manmade ponds and cisterns were not the only practicable measures to create independent water supply sources. Of far greater importance and value were the measures taken to make the water from natural bodies of water available for use. The sea, rivers, harbors, lakes, natural ponds, and ditches, etc., as a rule provided inexhaustible water supplies and proved the last resource of the firefighting services during large

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425 scale attacks when all other sources of water supplies failed.

Open water was to be found in practically all towns, and pumping points could be established usually at very low cost. Where constructional work was necessary, this was in the nature of building hard surfaced roads, piers, dams, platforms, pits, trenches, or pressure pump pipelines. For reasons of economy alone, regulations required that if at all possible only natural water sources were to be used if they were within 440 yards of a fire.

If marshy or periodically swamped meadow terrain made it impossible for motor pumps to approach close to the open water, firm roads were built or an open or covered ditch was dug, ending in a pumping pit. If there was no possibility to create direct approaches of the above types, permanently laid iron suction pipes were used. To prevent frost damage, permanent suction pipes of this type had to end above the water surface, so that the suction hoses of the motor

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426 pumps could be connected above or below the surface.

Many cities made large use of pressure pipes for suction lines to pump the water from open sources to the city areas where it was required. The pipes used were of iron or concrete (Schleuderbeton), and numerous pipelines of this description existed and gave excellent service. Some of them were up to 2 200 yards (2 Kilometers), and the water was taken from them by permanently installed or protable motor pumps at hydrants spaced approximately 330 yards apart. For quick use when needed, they were kept constantly filled with water, and were laid deep enough to protect them against frost. Their advantage over specially constructed water reservoirs in closely built up city areas was that they took up so little space.

Even small creeks and water conducting ditches were used as open sources of water if they had a flow of at least 264 US gallons (1000 liters)per minute, and even a flow of only 158.4 US gallons (600 liters) proved extremely useful with the use of very small dams.

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426 In the case of many cities, small water courses of the above type were conducted through underground canals. These canals and these constructed to carry rainwater were equipped with slide valves and other devices which could be closed off to dam up the flow of water when needed.

Where the water level was near the ground surface, shallow wells proved the next best method after open bodies of water to gain independence of the regular water mains. Where the water level was deeper than 24 feet (7 meters) underground and thus too deep for suchtion pumps, a remedy was sometimes found by placing the pump at a suitable depth in cellar type spaces walled in with brick. The pumps used here were portable and the costs of the arrangement were relatively small, in Berlin, for example only approximately 3000 Marks (714.28 Dollars) per well. The general minimum standard was that such water points were to be capable of delivering 264 US gallons per minute for a duration of four to six hours.

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427 In city areas where neither open water nor subsoil water could be used as an independent supply, plans for water supplies for firefighting purposes included the construction of special water reservoirs. In some cases the basins used in industrial concerns (for cooling or condensation and similar purposes), and indoor swimming pools were used as a reserve water supply, only very minor adaptations being necessary in such cases. In other cases the empty submersible ring wells (Tauchringgruben) of gasometers no longer in operation and large empty tanks were used to store water for firefighting purposes. Very often it was even possible to render the cellars of houses destroyed in air attacks watertght and use them for the purpose. This was often possible at a very small expenditure; in many cases it was only necessary to remove unnecessary dividing walls and cover the floors with a coating of watertight cement.

However, even after all of the possibilities discussed above had been exhausted, it remained necessary in many towns

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427 to construct special reservoirs for firefighting purposes. Of all methods discussed for the insurance of water supplies independent of the regular water mains, the construction of cistern and artificial ponds cost the greatest expenditure in labor, materials, and fuels. This was particularly so in the case of cisterns, which were underground covered con-

428 tainers. The constructional costs of one of these was twice as high as for a concrete pond of the same holding capacity. On the other hand, the cistern had the advantage that it required less maintenance and servicing and repair work. Furthermore, the supply of water was safe against weather even in the most severe cold; and being underground the cistern did not obstruct traffic or impair the beauty of a town. All of these reasons frequently contributed towards the decision in favor of the cistern.

In general, cisterns were constructed in accordance with a pattern developed by the Office of the Reich Minister for Aviation and Commander in Chief of the Air Force, which

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428 specified a barrel-type cavern ten feet (three meters) high on a squarefoundation eighteen feet (four meters) wide.

The decrees issued by the Reich Minister for Aviation and Commander in Chief of the Air Force through Air Force Inspectorate 13 on 27 November 1941 and 26 February 1943 included instructions for the construction of open reservoirs.

Widespread use was made of temporary artificial ponds, which were rendered watertight by a layer of tarboard pasted together or by a layer of tarcoated jute webbing, and of open concrete reservoirs with sand-supported walls.

With a view to the large capacity of the modern types of motor pumps used during the war, established standards required that each container should have a capacity of between 500 to 1000 cubic meters.

Since the requirements for water for firefighting purposes varied with the varying housing density and sensitivity to air attack of the city districts concerned, a problem frequently brought up for discussion was that of what reserve of

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428 water for firefighting purposes was to be held available per unit of area in the various built up zones.

To enable personnel of the slef-protection system to take water by bucket from the water containers, these were provided with steps or ladders having a hand operated lifting and lowering device.

429 To insure the refilling of reservoirs during use, even if the regular water mains should fail, a number of the reservoirs were always connected by pressure pipes which could be closed off when necessary. Furthermore, wherever possible they were connected by means of a natural flow with other sources of supply or could be so connected by means of hoses or quick-coupling pipe lines with a downward slope to insure a natural flow.

A general decree by the Reich Minister for Aviation (Runderlass LZ 4a Nr. 13 168/38) on 26 September 1938 ruled that all water supply points, such as pipe-cased wells, cisterns, ponds, developed with funds from the Minstry for

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429 Aviation to insure water supplies independent of the regular water mains in Category I passive air defense localities were to become the property of the communities concerned after completion. The community, in turn, was responsible for current maintenance and servicing of such water supply points.

Independent water supplies at any price is the key requirement for success in firefighting action as part of civil or passive air defense.

It is necessary here to base water reserve requirements on wartime experience factors. The subjects of the size, type, layout, and best structure of water reservoirs for fighting purposes will come under discussion by experts many a time before a relatively clear picture is developed on the basis of an analysis of all past experience. It is beyond doubt that in these discussions special consideration will also be given to deeply laid pipe system for the flow of waste and flood waters.[564]

564. See p. 17 of source quoted in Footnote 563, above.

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429 With wise foresight the Reich Minister for Aviation and Commander in Chief of the Air Force as early as on 15 February 1939 issued directives regulating the construction and operation of facilities making the drainage systems available as a source of water supply for firefighting purposes.[565] This necessitates mechanical devices for the purification of badly polluted water from the sewage system, a process to be handled under the directives by means of stationary or mobile means.

Furthermore, consideration had to be given to the necessary hygienic measures when, under exceptional circumstances, water from a foreign source had to be pumped in the potable water system. Appropriate instructions on this subject were given in decrees issued by the Reich Minister for Aviation and Commander in Chief of the Air Force on 30 April 1943 and by the Reich Minister for the Interior on 9 July 1943.[566]

Experience in World War II showed that a carefully considered technically well executed water supply plan for firefighting purposes is one of the prime conditions for successful firefighting action as a part of passive air defense, and that the German measures taken in this field did much to mitigate the effects of even very heavy air attacks.

The "Directives for Passive Air Defense Firefighting Action

565. Photostat copy in Karlsruhe Document Collection.
566. Karlsruhe Document Collection.

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430 (Richtlinien fuer die Brandbekaempfung im Luftschutz)" were consolidated in Air Field Manual L. Dv. 773,[567] to which annexes were published dealing with the various special subjects involved. Annex 1 (L. Dv. 773/1) for example, contains regulations on action to be taken against forest, moor, and heather fires (Die Bekaempfung von Wald-, Moor- und Heidebraende). and d sc ibes in particular detail the tactics to be applies in action against the various types of fires.[568]

3. Instalations Highly Sensitive to Fire Hazards. Special measures of fire prevention were necessary, for example, in the following fields:

(1) Mineral oil storage depots, as primary targets of attack required a number of special structural, organizational and operational measures because of their extreme sensitivity to fire.

The structural measures taken to protect them consisted primarily of masonry or, according to local conditions, unmorticed splinterproof protecting walls, and of catch basins to collect leaking oil and thus prevent endangering nearby storage tanks. These safety measures proved sound.

For more information on the organizational and operational measures taken the reader is referred to the section in the present study on the firefighting services.[569]

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431 (2) Gasometers were another source of acute danger. No matter what type of construction was used here the danger was present that damage done in air attacks could cause the escape of combustible vapors. Wherever this could be done without endangering gas supplies, such gasometers were taken out of operation at the beginning of the war. In building new gasometers dangerously close to residential or other buildings it will be necessary to insure in the future that only models are built which have no closed spaces in which gas-air combinations can form.[570]

(3) Film processing and film storage rooms were usually in the attics of buildings prior to the war. Regulations required their movement to locations where they would represent the smallest possible secondary fire hazard.

(4) Department stores could not be relocated because of their economic importance. Special measures were therefore introduced to protect them against fire.[571]

In the case of forest sections or areas the only possibility to improve protection was by means of wider and/or more fire breaks.

568. Photostat copy in Karlsruhe Document Collection.
569. See IV, b, 1, above.
570. Footnote 555, above.
571. See IV, i, above.

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432 6. The protection of grainfields and of crops in general was a mission of the rural passive air defense systems.[572]

Organizationally, all of the above came within the category of the "Extended Self-Protection System," and in all matters of passive air defense were supervised and supported by the appropriate authorities.

7. What were called "flash fire" installations, meaning establishments which were so highly sensitive to fire that the flash fires which could result if they were hit by bombs would seriously endanger nearby installations, required particularly stringent measures in the fields of lumber clearance, factory air defense, wide spacing, and relocation. This applied in particular to such establishments as roofing felt factories, sawmills, timber impregnating works with large stores of tar, and so forth.

In a decree dated 11 February 1941[573] the President of the Reich Defense Council ordered that all such installations in the close vicinity of militarily important armament factories were to remove all stocks and plant constituting a fire hazard and to close down immediately.

c. Blackout Measures. At the beginning of World War II air attacks could be carried out only by means of ground

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433 orientation. Therefore, it was of decisive importance to deprive an attacker of all means of orientation at night. Apart from camouflage, the only means available for this purpurpose was that of a blackout, which would insure that neither industrial works nor localities could be identified by their lights. Many and widely diversified problems remained to be solved, however, in the technical field to insure that traffic and production would not be interrupted, or at least to reduce such interruption to a minimum.

The Office of the Reich Minister for Aviation and Commander in Chief of the Air Force formulated the necessary requirements, through Air Force Inspectorate 13, supervised their enforcements, and participated in the development, testing, and approval of the numerous blackout devices used.[574]

434 Two stages of blackout were approved, namely,

(a) the limited lighting stage
(b) the complete blackout.

The purpose of the restricted lighting stage was to conceal the brilliant illumination emanating from lighted cities and industrial works. This objective was achieved by reducing all lighting to the lowest tolerable minimum.

Real protection of a target of attack against observation from the air was achieved only by the second stage of complete blackout, which had to be effected with swift

572. See IV, i, above.

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suddenness immediately enemy penetrations were reported.

The "limited lighting" stage of blackout was imposed as a permanent measure immediately after the outbreak of the war. Residential houses were to be kept completely dark from the outset, since no possibility existed here to effect a swift and sudden complete blackout. The "blackout (Verdunkelung)" order given by the air raid warning service when enemy aircraft penetrated therefore applied only to public lighting and to the industry.

The "limited lighting" effect was achieved by using only those outside light which were indispensable for smooth traffic movements and for work which had to be done in the open, by insuring that such lights were properly covered against detertion from above, and by insuring that no lights would penetrate from the interiors of lighted buildings. Outside lighting had to be reduced radically. Traffic signs had to be covered on the top, and all advertising lights, standard time clocks, traffic halt pillars, illuminated signs, and shopwindow lights had to be extinguished.

The blackout order was given for the area currently threatened by the appropriate air raid warning detachment.[576]

573. Karlsruhe Document Collection: "~~Schutz Kriegswichtiger~~ Betriebe vor brandgefaehrlichen Nachbarbetrieben, 11 February 1941.
574. See III, g, above.
575. "Tarnung und Verdunkelung," by Dr. Ingenieur Herbert Knothe in Knipfer-Hampe: "Der zivile Luftschutz," p. 327.
576. See IV, a, 5, above.

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435 Very specific difficulties were encountered in preparations for blackout measures to be applied under the responsibility of the Railway Administration, the Ports and Waterways Administration, and large industries.[577]

A legal basis for the enforcement of blackout regulations existed in the Eighth Decree in Implementation of the Civil Air Defense Act, known as the "Blackout Decree (~~Verdunkelungsverordnung~~).[578] This decree, which was modified repeatedly later in line with more current experience, stated the requirements for the screening of lights and apertures through which light could penetrate, and traffic signal and other traffic lights, and defined the various fields of responsibility.

The "First Effectuating Regulations to Paragraph 18 of the VIII Decree in Implementation of the Civil Air Defense Act (~~Erste Ausfuehrungsbestimmungen zum Paragraphen 18 der VIII Durchfuehrungsverordnung~~)"of 22 October 1940 introduced the use of blue lights for specific purposes. No records are available on special experience on this subject.[579]

Detail statutes regulating the dimming and screening requirements for lights on motor vehicles and trailers, bicycles, horsedrawn vehicles, push carts, streetcars, elevated

577. See IV, e, 2, above.
578. Karlsruhe Document Collection:"~~Luftschutz-recht~~", p.108 and "Luftschutzbestimmungen," both photostat copies from the journal "Bauwelt."
579. "~~Luftschutzrecht~~," p. 123, see Footnote 578, above.

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435 railways, and cableways were published in "Effectuating Regulations to Paragraph 18 of the Eighth Decree in Implementation of the Civil Air Defense Act dated 4 July 1941 (promulgated in ~~Reichsgesetzblatt~~ I, p. 455).[580]

All vehicular and pedestrian traffic had to halt when the air alert was sounded. Excepted from this basic rule were matters of official business, and in exceptional cases certain individuals, such as physicians, midwives, newspaper personnel, etc. A uniform marking was introduced for vehicles permitted to travel on public roads and streets during air alerts.[581] Approval to use this marking could be obtained from the local passive air defense chief in the form of an official stamp on the marking. Motor vehicles with this marking could only be halted, during air alerts, if this was necessary for particular reasons.

Highly diversified research and development work was necessary in the field of traffic. Finally a "concealed" headlight was developed, which, as confirmed by repeated observations from the air, could not be detected by an attacker under normal weather conditions and at the same time did very little to interfere with vehicular traffic on the roads. The introduction of this ~~XXXXXXX~~ headlamp with its single-wire 35-Watt bulb removed one of the most serious hindrances during total blackouts and, together with another statute

580. Ibid, p. 126.
581. Karlsruhe Document Collection: "Kennzeichnung von Kraft- von Kraftfahrzeugen--Continued

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436 requiring that all important points and danger points, such as road intersections, bends, traffic islands, and river bank roads, buildings or parts of buildings in traffic lanes, etc., were to be marked by means of a coat of white paint on the roadside kerb, house walls, fences, etc. All of these measures gave excellent results.

Legal requirements provided that blackout relaxations could be approved. This authorization was required particularly by industrial concerns, where compromises were unavoidable in the interests of production.

~~Blackout Requirements in the Industry~~.

Measures to screen the lights and the reflection from fires used in the industry, particularly in the iron working industry, presented what was probably the most complicated problem, since the measures required for the purpose could not be put into effect without a serious impact on industrial output. It was altogether impossible to establish detailed regulations on the measures to be taken to screen fires, since the operating and general local conditions differed widely in the individual works. For this reason only general directives were issued on this subject and it was left to the discretion of the individual works, in consultation with the local chapter

581.-Continued: ~~die bei Fliegeralarm verkehren dürfen~~, "~~Rund~~-Erlass des RF. SS u. Chef der deutschen Polizei und des ~~R. d. I. u. Ob. d. I. vom 5. 5. 1943~~ (~~MBl. i. V.~~, p. 772).

582. See IV, e, 2, above.

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437 of the Reich Board of Industries and under control by the appropriate air district commands, to take the measures which actually could be effectuated under local and operational conditions.

The following are a few items from experience gained in some of the most important industrial plants:

(1) Blast Furnaces. In most cases provisional light screens were erected on the tapping and slag runner side. When metal was tapped into the forming beds, the whole bed was enclosed by a screen with a ceiling and with screened ventillators, an arrangement which arrested the light reflections satisfactorily. U-iron frames with corrugated iron sheeting served to screen the reflection superficially, but were not adequate to achieve a complete blackout.

For tapping into ladles, a brick wall erected in a height of between 18 and 22 feet (4-5 meters) at some distance from the tapping spout proved satisfactory.

Blast furnaces built during the war were planned from the outset with the appropriate blackout facilities, which gave satisfactory results. Ladles containing pig iron or slag and which could not be covered with a proper lid were covered with a thick layer of sand for transportation. Traffic on the factory railways was made

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438 possible at night by light funnels (Lichtschleusen) at the entrances to the tunnels under the blast furnace installations.

(2) Blending Plants. Experience in World War II show that it is possible to conceal a large part of light reflections from metallurgical processes.

Pig iron ladles on the way from the Thomas or Martin works were provided with detachable plastered covers. Slag and/or pig iron trains were assembled in special "tunnels" of light iron framework covered with corrugated iron sheeting. Trains en route could be halted under cover of darkened buildings if the advance warning was received soon enough.

(3) Steel Works. In "Thomas" basic Bessemer plants the fire reflection from the converter had to be concealed, in Siemens steel works the reflections which occurred during filling, finalizing, and tapping. To some extent this was possible by technical means and by operating arrangements.

(4) Foundries. Here, the entire casting or forming bed was enclosed in a hall, as was the case in blast furnaces when the metal was tapped into forming beds; or the open ends of the hall were screened by spaced walls with overlapping ends, which did not

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439 hamper movements on the factory railroad, an arrangement also used to screen the tapping halls of Siemens-Martin steel works.

(5) Coking Plants. Serious difficulties were encountered in efforts to screen light reflections from operations in coke plants. The only possibility for complete concealment would be to have the entire furnace plant under a roof.

Since it was realized that the possibilities of screening here were inadequate, the only other course open was to so improve the warning system that every safe moment could be exploited for plant operations.[583] In combination with a special system of restricted lighting this finally made it possible to maintain production in spite of the increasing frequency of air attacks, which applies not only to coking works but equally to all other large industrial plants.

(6) General. During the early phases the air district commands complained that the the limited artificial lighting allowed in factories and other installations did not meet blackout requirements. Various measures were introduced in response to these complaints. One measure was the replacement of of the generally used wide lamp shades, which permitted side reflections, by

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440 funnel shaped lamp shades, which directed the light rays downward and prevented direct reflection to outside. In large machine halls and workshops, where the working processes required great precision, the use of individual bench lamps was introduced, a measure which resulted in reduced output during the initial stages. The sharp contrast between the directed rays of the bench lamp and the surrounding darkness affected the eyesight of the personnel and thereby the manufacturing processes.

The ceiling lights in large workshops presented serious problems. The usual methods employed here were to darken the lampglasses by a coating of paint or to provide them with screens.

Mechanical methods to screen light as a rule imply that all apertures which would permit light or reflected rays to penetrate to the outside must be hermetically sealed. As a result the workshops, and this applied even to very large halls, became so hot that work performances suffered seriously, in many cases dropping to less than 50 percent of normal performances.

The use of curtains to screen the windows of large industrial workshops proved ineffective. A useful method was to have shutters of some hard material and run in a groove, which insured proper closing at the sides. The

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441 most practicable method proved to be the use of screen sections which could be hung in position, moved about, and bolted to the walls. When screens of this type were used on the outside of a building they also to some extent protected glass windows against air pressure and suction.

Assuming that it will not be possible to dispense with blackout requirements in any future war, it will remain necessary in the future to allow certain exceptions to the general blackout regulation for traffic and wartime manufacturing activities. Even in the future important individual targets will come under low level attack requiring ground orientation.

The requirement to have more flexible methods of blackout can be met only through continued technological improvements and in particular through further improvement of warning methods and techniques.

d. ~~Camouflage and the Means Employed for Camouflage Purposes~~. The purpose of all camouflage measures is to conceal or screen something actually in existence and to create misleading appearances. The concealment of probable targets of attack within German territories was thus a mission of

582. See IV, e, 2, above
583. See IV, a, 6, above.

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passive air defense.

Three possibilities existed to make it impossible or at least difficult for an attacker to detect his target:

(1) Camouflage concealment of the target itself

(2) Smoke screening

(3) The creation of dummy installations.

1. Target Camouflaging. The camouflage measures taken and their success depends on the enemy tactics of attack at any given time. During the phase of penetrations by individual aircraft, it was important to so conceal the target that it could not be picked out of its surroundings. In the case of new structures consideration had already been given to camouflage requirements in the matter of site selection.[585] Actual camouflage was achieved by the use of concealing colours, camouflage nets, and camouflage structures.

The effectiveness of camouflage colours is restricted in the case of already existing buildings and installations. In the case of an open space within a town, for example, it would have been useless to create the appearance of streets and building blocks by the use of colours.[586] In the case of groups of houses close to a well camouflaged industrial installation, in contrast, it was a wise measure to replace their light painting by a coating of paint which blended with the surroundings.

584. "Tarnung und Verdunkelung," by Dr. Ingenieur Herbert Knothe, in Knipfer-Hampe: "Der zivile Luftschutz."

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442 In rebuilding or building extension projects it was just as important as in the case of new structures to start with a selection of the properly colored building materials. In a pinetree forest, for example, the only proper selection would be a clinker structure with a roof of dark brown tiles.

Numerous possibilities thus existed and will continue to exist in the future to conceal important individual targets, in ~~xxxxxxx~~ attacking which the enemy will hardly consider simultaneousl release mass bombing (Bombenteppichwurf) profitable, but which nevertheless will be highly important for the industry and traffic of the defender.

Camouflage painting on a plane surface cannot produce successful results because they cannot create the appearance of deep shadows. This was why the camouflage installations on the Alster in Hamburg, carried out at high cost, could produce only small results. Another complicating factor in the case of Hamburg was that the direction of the rail tracks betrayed to an experienced airman the actual position of the Lombard bridge and the adjacent city.

On the other hand the color camouflage of runways was successful in the first years of warfare in cases where the other airfield installations were also successfully concealed. Success here was due an appropriate assortment of colors and

585. See VIII, a, 2.
586. Appendix 33: The Camouflaged Koenigsplatz Square in Munich (Air Photo).

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443 an appropriate scheme of simulated terrain subdivision.

The three branches of the military establishment in their separate fields of authority and responsibility carried out their camouflage measures themselves , with the air district commands acting in a consulting capacity, in line with the driectives established by the Reich Minister for Aviation and Commander in Chief of the Air Force through Air Force Inspectorate 13. Within the Air Force a special Camouflage Committee (~~Tarnungsausschuss~~)was established for the purpose,which convened whenever required under the chairmanship of the Chief of the Air Photo Branch.[587]

Camouflage concealment of the Autobahn superhighways presented a very special problem. Soon after the second and third phases of construction commenced, the Reich Minister for Aviation and Commander in Chief of the Air Force, through Air Force Inspectorate 13, demanded a dark surface for all roadways and bridges in the highway system. This would have been possible at a very small extra cost in expenditures. However, it was impossible to obtain the necessary authorization. In fact Hitler, to whom the matter had to be submitted for final decision, stated that he was building the highways for the purposes of peace and that a dark surface could not be taken into consideration. For this reason

587. Karlsruhe Document Collection: "Bearbeitung von Tarnungsangelegenheiten 1940," Decree by the Under Secretary of State and Inspector General of the Air Force, 14 February 1940.

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444 temporary camouflage teams were activated, who at the beginning of the war sprayed at least the most important sections of the Autobahm superhighways with a dark color.

Large use was also made of camouflage mats of various constructions. In the final essence, only nonflammable materials could be used for this purpose. Mats of this type were used most frequently to conceal cast shadows, for example in the case of buildings or bridges. Industrial installations also used them to conceal conspicuous or vitally important parts of works. Here it was found, however, that the mats and the stays holding them in place seriously impeded firefighting and rubble clearance operations when they fell on to factory installations or approaches during an attack.

At least during the first years of the war camouflage mats together with rafts proved very useful to conceal a few of the side canals leading off from main shipping waterways. This was particularly necessary when the direction of the side canal facilitated the finding of the vital parts of an industrial concern, as was the case in the Wattenstedt-Salzgitter industrial region.

445 Later, when the attack tactics of mass bombing commenced, the concealment of individual targets in such areas became

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445 unimportant. Techniques had also improved in the matter of orientation, which now no longer depended on optical aids. The expenditures in personnel and materiel for camouflage and concealment purposes was thus out of proportion to the results achieved, although the use of all means available still made it possible to protect certain individual targets and important vital points against low altitude attacks by means of camouflage.

In attacked industrial works, the ruins of destroyed buildings were left standing for the time being, so that enemy reconnaissance units could report complete success. It is to be assumed that this method produced some success in the beginning, because in numerous cases the repeat attacks which would normally have been expected did not materialize. Later, however, this "camouflage by ruins" was of little significance.

The need for protection against attacking aircraft using heat orientation homing devices influenced the appropriate agencies, under instructions from the Reich Minister for Aviation and Commander in Chief of the Air Force through Air Force Inspectorate 13, to initiate research projects of a most widely varying nature. The methods used were special paints and specially prepared construction materials,

588. See III, g, above.

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445 the use of which required prior approval by the Reich Institute of the Air Force for Passive Air Defense, and were then designated as proof against infra-red orientation (spannersicher)[588].

The enemy had meanwhile developed a special thermal device which could detect the infra-red rays of light at a great distance. Against aircraft using this instrument there was no possibility to conceal the light emanating from large industrial works. The first countermeasures tried were a series of tests to determine the degree to which individual works were proof against infra-red detection. Parallel with these measures, other measures were tried out to prevent detection of infra-red rays by the enemy instruments.

Investigations showed that the following gave off particularly noticeable rays:

The smokestacks of steel works

Slag ladles

In coking plants the filling apertures, the standing or wising pipes (Steigrohre), the levelling covers, and the vents to the gas columns.

Grid gas works (Ferngasoefen)

Cold process gas ovens (Kaltgasoefen) in open-hearth (Martin) steel works.

Even unloaded slag, although covered with a black top coatingand although no signs of light were visible to the

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446 618 naked eye, gave off strong reflections because of the heat engendered under the crust which formed on top.

It proved exceedingly difficult to protect slag ladles, etc., against infra-red detection. The best solution was the use of slag wool mat screens standing at a distance of approximately eight inches (20 centimeters). Satisfactory results were also obtained by placing 0.1576 inch (4 millimeter) wire netting 25 centimeters, 9.94 inches, above the oven covers or other object to be screened. The screening effect of the wire netting was due to the same physical principles which apply in the use of ~~xinxx~~ brass wire netting in miners' lamps.

447 In the case of smoke stacks , the gas feed to the ovens was closed off and the smoke stack vents were shut when enemy aircraft were reported approaching, a process which actually prevented infra-red emanations almost completely.

No factual experience is available on whether the methods just described were effective, nor on whether the enemy actually made use of the aforementioned locating devices.

The matter was different in the case of protection against radar locating.

At the time when the first enemy airplane equipped with radar was captured at Rotterdam (which was the reason why

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these instruments were generally termed Rotterdam instruments on the German side), the German industry had not yet developed radio locating instruments operating on the wavebands used in the new instrument. After superficial repair, the captured instrument was therefore in demand by the most varied agencies, including those responsible for camouflage and concealment. Makeshift devices using suspended dipole antennae and with tinplates fastened crosswise on a floating wooden cross gave some satisfaction. An adequate number of these devices massed together could serve to alter the reflection shown on the radar screen. Thus, parts of the Wannsee Lake at Berlin and of the Duemmer Lake in the Hanover area were screened against radar detection in this way. With the continued improvement of radar instruments, however, the measures thus taken could no longer produce successful results.

2. Smoke Screening. Long in use by the Navy for protection against horizontal observation, smoke came into use at a relatively late juncture on the ground against observation from the air.

Smoke screening tests had been carried out in 1929 by industrial firms with cooperation from the authorities at the large Friedland electric power station in Eastern Prussia, but it was September 1937 before the first large-scale

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448 smoke screening exercise was staged in industrial terrain at Stettin.[589]

The Reich Institute for Passive Air Defense had, in the meanwhile, developed equipment suitable for smoke screening operations on land. A report on the exercise, together with a sketch, will be found in the source quoted in Footnote 589, above.

The only smoke generators available at the time were stationary. When it became necessary to close gaps in the smoke screen, or if the wind changed, additional smoke generators had to be transported by truck from a reserve depot to the necessary points.

Other large-scale smoke screening exercises were conducted later in Hamburg and at various important industrial works.

Air observation furnished the necessary data for the tactical use of the newly developed means of concealment, and led to the activation of special units to operate the smoke generators.[590]

Initially, the personnel for these new units were taken from the industry and from the Passive Air Defense Police, but it soon became evident that mobile units would have to be

589. Karlsruhe Document Collection: "Entwicklung und Verwendung von Nebelgeraeten," by Colonel Fritz Themme.
590. See V, b, and V, b, 1, above.

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448 available for special circumstances, which would be able to operate from their smoke wagons. The first vehicles used for this purposes were, in some cases, tanker trucks seized during the occupation of the Sudetenland as property of the former Czechoslovakian armed forces, where their original purpose had been to spray toxic gases in battle areas. Now they were to serve purely defensive purposes. The smoke generator which had in the meantime been developed was the Nb 80/2, and the Office of the Reich Minister for Aviation and Commander in Chief of the Air Force, through Air Force Inspectorate 13, issued the necessary regulations as Air Field Manual L. Dv. 789/1.[591]

Experience showed that a smoke screen, in order to be effective, must cover a large area around the target to be protected. In the case of factories located within towns, smoke screening seriously hampered traffic within the town areas. In the case of large industrial works, the smoke screen had to be very dense and had to extend far upward; otherwise reflections penetrated through the screen unless they were completely absorbed by special light screening devices. Furthermore, if the smoke screen was not high enough high industrial structures, such as tall smoke stacks, etc, which were particularly prevalent in the iron working and chemical industries, in mining, at coking plants, at cement

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449 factories, in port installations, and included structures as high as 200 to 260 feet, stood out above the smoke screen and served as guides for attacking bomber forces. Success therefore hinged upon an adequately high smoke cover placed over the protected area early enough. Whether a smoke screen will remain in place, and the duration of the smoke screen, depend largely on wind and other weather factors.

Very frequently the uncertainty as to the timing and place of an impending air attack resulted in belated or otherwise ineffective smoke screening. Smoke in all cases complicated orientation for personnel on the ground, and thus

450 complicated damage control action .

In the early stages of air warfare smoke screening prevented the destruction of many a factory, so that the accompanying disadvantages had to be accepted. When the smoke screen had to be maintained for any length of time these disadvantages included difficulties in the manufacturing processes; increased traffic hazards, particularly in loading rail depots; and increased accident rates, particularly in factories and so forth in the handling of heavy articles.

After the attack was over, the smoke naturally complicated swift firefighting, rescue, and salvage operations.

591. Karlsruhe Document Collection: Air Field Manual L. Dv. 789/1, "~~Das Nebelgeraet Nb 80/2~~."

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450 Some industrial works complained that the corrosive action of the smoke producing acids used damaged their highly sensitive instruments and commodities.

In June 1939 the Reich Air Ministry and Inspectorate 9. of the Army High Command again staged a large-scale smoke screening test exercise at St. Goar and St. Goarshausen. The purpose was to determine whether it would be possible by means of smoke screening to protect effectively against air observation a bridge planned across the Rhine River connecting these two localities.

In the exercise smoke was projected from 150 positions along both banks of the Rhine River, and some of them on the nearby hills. With a north wind blowing, practically the whole river valley was covered by smoke, so that visual observation and detection of the bridge would have been impossible.

A remarkable feature in this test exercise was that the smoke screen remained in place far longer than had been anticipated, an observation confirmed repeatedly by later experience. Investigations showed that in conditions of very high atmospheric moisture near the saturation point, smoke causes the development of natural fog.

451 Preparations continued up to the end of 1940 for the use of smoke screening in passive air defense operations,

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451 but no large-scale practical use was made of this means of concealment. Plans and investigations for smoke screening operations at bridges over the Weser-Ems Canal north of Muenster, for example, did not proceed beyond the initial stages.

Early in 1941 a smoke unit of the Safety and Auxiliary Services was organized at Bremen. This unit was expanded in the spring of the same year to form a smoke battalion. In the spring of 1941 the Navy High Command approached the Commander in Chief of the Air Force with a request to smoke screen the naval port of Brest for the protection of heavy naval units there, particularly Battleship Bismarck, which was to arrive there shortly. The smoke battalion of the Safety and Auxiliary Service formed at Bremen was moved to Brest early in May for this purpose. Approximately at the same time the first smoke units were activated to protect targets within the Zone of Interior. From then on smoke was used on a steadily increasing scale.

~~Smoke Screening Operations at Brest~~.

The smoke battalion originally organic to the Safety and Auxiliary Service comprised three units (~~Bereitschaften~~), ~~xxxxxxxxxxxxxxxxxx~~ one of them equipped with ten of the previously mentioned captured Czechoslovak chemical trucks.

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451 Each of the other two units had 54 smoke generators mounted by threes on trucks, from which they could also lay a smoke screen whenever necessary. The performance capacity of the ten captured tanker trucks was about equal to that of 54 smoke generators.

452 The units, which from now on will be designated companies in this translation, were organized each in three platoons of three squads, with 3 tanker trucks or 3 x 6 smoke generators to each platoon. The whole battalion was fully motorized and could displace whenever necessary during operations.

In the summer of 1941 the battalion was incorprated with the Air Force.

This first smoke battalion in existence was assigned directly under Antiaircraft Artillery Group Brest. Acting on recommendations from the smoke battalion commander, the AAA group commander gave the necessary orders for tactical action In all other respects the smoke battalion commander was completely independent in his action, and in particularl decided on his own responsibility any change of positions which changing winds might make necessary.

During uncertain weather conditions it was found advisable to hold some units in tactical reserve, which could be moved into position speedily to extend a flank if this became

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452 necessary. Displacements of this kind were frequently necessary because the personnel and materiel available were not adequate to provide sufficient smoke projecting positions to give a target adequate protection. The smoke battalion had tactical control over a flotilla of approximately 40 smoke projector boats, which were to place a smoke screen covering the outer anchorage areas.

During the summer and autumn months British air attacks against Brest as a rule were during the night. The smoke units therefore during the initial period only went into action at night. The operating personnel were in quarters outside of Brest. Two hours before sunset they proceeded to their daily assigned positions, which were decided in accordance with predicted weather conditions, so that the whole battalion was ready for action at the fall of dark. At sunrise all personnel were released to return to their quarters. However, these procedures could only be maintained during the season of not too long nights and whileattacks remained restricted to nighttime. Later, battalion personnel had their billets at their smoke positions and remained there when not under alert.

No records are available on how often the heavy naval units came under air attack. However, one officer does

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453 remember that during his few months in command of the smoke battalion in 1941 fifty attacks occurred. None of the ships was hit in these attacks, with the exception of the Prinz Eugen, which was struck by a jettisoned bomb. Even the enemy conceded that the large area screening operations made aimed bombing impossible.

The smoke screening frontage at Brest was approximately 8 800 yards (8 kilometers). During conditions of high atmospheric moisture, which was usually the case in the anchorage area, the smoke covering extended over an area approximately 12 miles deep, so that when a northerly wind was blowing practically the whole town, port, and anchorage were protected by a screen of smoke. The largest area covered at any one time was 61.176 square miles (160 square kilometers).

The smoke screening operations at Brest produced the first tactical experience for application later in operations within the Zone of Interior. The most important point was recognition of the fact that timely orders to commence smoke screening was a highly important condition of success, in order to cover the target with a deep enough screen of smoke before the attacking units arrived. It is only natural that wind velocities played a considerable role here. With winds of low velocity the smoke generators must be arranged in greater depth, meaning that some of them must be moved closer

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453 to the target to be protected.

The smoke producing acids destroy plant growth near the smoke generators, so that the smoke positions can be detected easily by air reconnaissance, particularly if they are in a regular line or pattern. To avoid detection by enemy air reconnaissance it is wise for smoke units to change their positions frequently.

Properly functioning signal communications proved a decisively important factor. All units of the smoke battalion down to platoon level were plugged in to the telephone network. In addition all platoons had radio equipment. Motor cyclists were held in reserve as messengers, but could not always be used because of the hampering effects of the smoke. Only when the communications network was intact was it possible to speedily close gaps recognized in the smoke cover. In the Brest area in particular, such gaps occurred frequently because the direction and velocity of winds varied widely during periods of low velocity winds in the large area of operations.

Being right within the bombing areas, the smoke generator operating crews usually had shelter trenches in the immediate vicinity of their generators, so that they could take immediate remedial action in the case of failures.

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454 The good results obtained with the first smoke battalion, designated as the 1st (mtotrized) Air Force Smoke Battalion, led to activation of the 2d Motorized Smoke Battalion in Norway for protection of Battleship Tirpitz.

With the exception of these two battalions, the only smoke units existing at the time were permanently stationed non-motorized smoke companies, some of them organized to form battalions, which had only the vehicles indispensable for the movement of ration and smoke producing acid supplies. When displacing, these units had to request transportation from the appropriate AAA groups.

Besides the smoke units activated by the Air Force, some of the more important industrial installations employed their own factory personnel in smoke screening activities, as was the case in the works of the Daimler-Benz A.G. concern in Untertuerkheim. Here also the results were good.

The activation of further smoke companies was primarily a matter of smoke acid production. The current output was inadequate for the requirements of air warfare, particularly so because of the steadily increasing requirements of the other military branches, the Army and the Navy.

For this reason a commission comprising members from each of the three military branches under the chairmanship

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455 of a representative from the Supreme Military Command was formed in 1943. In cooperation with the Armaments Ministry and representatives from the industry, this commission worked out a smoke acid manufacturing plan and assumed responsibility for allocation for the output.

Plans provided for a monthly output of 30 000 tons. However, this goal was never achieved, and outpot at no time exceeded 20 000 tons in any one month.

There can be no doubt that the use of smoke screening in the first years of the war met with considerable success. This was proved indubitably by the pattern of bomb hits, for example in the case of the Leuna Works, and in the Rumanian oil region of Ploesti. No records have been uncovered on the results of large-scale smoke screening operations to protect the port areas of Hamburg, but German night reconnaissance planes sent up to check the smoke cover turned in reports that prove that aimed bombing would at least have been difficult.

The smoke acid supply bottleneck not only placed restrictions on the activation of new smoke units, but also on the expansion and improvement of existing smoke installations.

In aases where a smoke screen was not large enough it served to guide attacking enemy air forces to their target

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456 where they were then able to accomplish their bombing mission by mass simultaneous release tactics.[592]

The Commander In Chief, Center, therefore on 22 April 1941 issued the following directive:

> It appears good practice to use smoke in combination with light effects and bomb-caused fires to simulate the presence of large dummy installations. The significance of large dummy installations was clearly demonstrated during the attack against Berlin on the night of 17-18 April 1941. Smoke screens, light effects, and bomb-caused fires were used in the V 500.
>
> The results:
>
> 12 explosive bombs and approximately 200 incendiary bombs struck Berlin
>
> 52 explosive bombs and approximately 1380 incendiary bombs struck V 500 and nearby dummy installations.
>
> From the outcome of smoke screening tests within my command area I consider it a logical conclusion that continued exploitation of these tactical possibilities, with an occasional change in locality, will be wise[593]

592. Karlsruhe Document Collection: "Vernebelung von Industriewerken," excerpts from report by a naval officer, 3 Spetember 1940.
593. Ibid: "Einsatz von Nebelabteilungen 1941," Order by Luftwaffenbefehlshaber Mitte Fuehr. Abt. I, Ia op 3 (LS), 22 April 1941).

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456 The following report is available on the results of smoke screening operations at the naval shupbuilding yard of Wilhelmshaven:[594]

From 1942 on smoke screening was used to conceal important targets, such as ships, and shipbuilding, lock, and port installations, for which purpose the shipbuilding and town area were placed under smoke screens. The operations were organized in three perimeters.

The smoke generators were operated in the shipyard and port areas (the second perimeter generators by passive air defense personnel of the shipyard wearing light gas suits). The first, or outer perimeter, was 330 yards offshore in the Jade, and followed the contours of the coastline. Here the generators were on board former fishing cutters and were operated by naval personnel. This perimeter extended farther on shore to encircle the fortress area, where the projectors were operated by an Italian smoke battalion. The third perimeter was within the town area and served to close gaps in the smoke cover. Here also the generators were operated by Italian personnel.

The smoke screening operations functioned excellently and continued up to the end of the war. It precluded any

594. "Werft- und Hafenluftschutz," by Karl Kramp, Wilhelmshaven, in "Ziviler Luftschutz," Volumes 6-8, 1955, Verlag Gasschutz und Luftschutz, Koblenz.

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457 possibility of aimed bombing, and numerous bombs dropped harmlessly into the Jade in spite of Radar or Rotterdam instruments.

For more detailed information on smoke screening operations in the fields of command, organization, techniques, and technology the reader is referred to the article "Smoke Screening for Concealment in Passive Air Defense in World War II (~~Kuenstlicher Nebel im 2. Weltkrieg als Tarnung im Luftschutz~~)" by Major Worringen.[595]

Smoke screening will still be of some significance in the future, for example, to protect important individual targets such as valley dams.[596] However, if even the enemy aircraft dispatched to attack individual targets are all equipped with radar locating devices, smoke screening will have lost its importance.

3. ~~The Use of Dummy Installations~~.

aa. ~~Basic Principles~~.

The purposes of dummy installations are as follows:

(1) Dummy installations are designed to mislead an enemy unit concerning the actual location of their target of attack, and cause them to expend their ammunition on the simulated target.

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458 (2) The simulated bomb-caused fires started during an attack against the real target or the simulated or dummy installation were designed to deceive the enemy concerning the success of their attack and cause units following up the attack to unload their bombs in the areas marked by the simulated fires.

(3) Simulated signal rockets were installed at important dummy installations. At an altitude of approximately 6 600 feet these rockets released target marking light signals resembling those used by the enemy. The purpose was to mislead the enemy bomber units following up the enemy target marking units concerning the position of their targets of attack.

(4) It was essential to simulate antiaircraft fire (by pyrotechnical means giving the appearance of muzzle flash) since the dummy installations otherwise would soon be recognized as such.

Dummy installations were to be used in addition to other means of defense and protection primarily to protect such targets as airfields, important installations of the armament industry,[597] traffic installations, and city areas. The most

595. Appendix 34.
596. See IV, h, 2, above.
597. Appendix s 35-36: Dummy installations to protect the oil refineries at Poelitz and the Skoda Works at Pilsen (Photos).

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459 important means used for purposes of deception were smoke screening; light effects; structures; artificial watercourses, roadways, and traffic installations of all types, all of which had to fit into the position and general pattern of the target for protection and its surroundings.

The first tests in this field were carried out by industrial concerns as early as in 1935. At that time the light effects were still achieved by means of stable lights suitably placed and hand-operated. By the beginning of the war the whole system had undergone unexpected developments and relied on the most complicated constructions.

The first question in establishing a dummy installation was that of selecting a target to be protected. Primary targets here were industrial works and other installations the preservation and operation of which were of vital importance for the military potential, and which were seriously exposed to and, by reason of their nature, particularly sensitive to air attack, so that it appeared desireable to give them added protection, by means of leading attacking units away from them, in addition to the normal means of defense and protection.

The next problem was that of site selection for the dummy installation. Here it was not only important to choose terrain similar in size to the target which was to be copied; it was also important to select a location

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459 was also important to select a location as free as possible of damagable property and even as distant as possible from settled areas, so that there would be no necessity to apply the terms of the law regulating the requisitioning of property and services for military purposes in order to evacuate and indemnify large numbers of persons.

The decisively important requirement was to have the dummy installation in the assumed enemy line of approach and on the approach side of the protected target, and to locate it in a similar relation to salient terrain features (such as rivers or railroads) for terrain orientation as the protected target. Lacking such na-
460 tural orientation points in the terrain, it was essential to simulate them, also by means of dummy installations.

In the initial stages all planning proceeded on the assumption that bombing attacks would occur primarily at night. Therefore the first installations were limited to light arrangements of a very primitive nature designed to give the natural appearance of normal working procedures at night and thereby deceive the enemy.

In constructing dummy installations there was no need to adhere strictly to the pattern and size of the original being copied. In most cases it was sufficient to give an indication of salient features in the lay out, to give the appearance of

598. Karlsruhe Document Collection: "Scheinanlagen," excerpt from a supporting study for a history of air warfare, Volume 8, "Reich Air Defense," Project von Rohden.

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460 inadequate application of blackout measure, visible from the air, and to simulate technical light effects. An important role was played here by the presentation of inadequately or badly darkened factory rail lines by means of stationary or loosely hung lamps with inadequate screens, rail installations with signal or switch lights placed over a few lengths of rails; the simulation of port installations by means of a few shallow canals and basins reflecting the light from overhead lamps. Other installations simulated factory buildings by means of light streaming through a few windows; large machine shops marked by light shining through glass roofs and by blue flames seemingly from welding work. Smoke produced by chemical means also played a large role.

It was easy to achieve a realistic simulation of the working processes in a coking plant, such as the glare of flames during filling, the glare from the strams of lava when the coking ovens were depressed, or the bluish sparks generated in the electric guide rails during passage of the slaking car with its load of red hot material, as well as the clouds of white steam from the slaking tower.

461 In like manner it was an easy matter to simulate the far more brilliant flames occurring during various working processes, such as the top flames of blast furnaces, the reddish glow seen during the tapping of pig iron, and the fiery

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461 stream of flowing slag.

The selection of sites for dummy installations was a responsibility of the passive air defense sections of the various air district commands, in cooperation with the numerous other agencies involved.

For the industries supporting the Air Force a standing arrangement existed that the Chief of Special Supplies and Procurement Services had the sole right to decide whether and where dummy installations were to be constructed, and in what manner it was to be illuminated.[599] Accordingly, he also had to provide the necessary funds. In all other cases the Reich Minister for Aviation and Commander in Chief of the Air Force bore all expenses for the construction of dummy installations except in the case of industrial concerns and traffic installations, where he was responsible only for a certain percentage of the costs.

bb. ~~The Operation of Dummy Installations~~. The first dummy installations placed in operation were serviced and operated by the increased personnel of the concerns involved, particularly in the case of industrial concerns. In the meantime special units were being activated within the Passive

599. Karlsruhe Document Collection: "Schein- und Tarnanlagen fuer die Luftwaffenruestungsindustrie 1940," Teletype message from Reich Marshal Goering to the Chief of Special Supplies and Services, 24 July 1940.

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461 Air Defense Forces for assignment to the various air district commands to service and operate the numerous dummy installations developed in 1941-42. Initially the new units were designated "Special Passive Air Defense Companies;" later they were consolidated to form "Special Purposes Passive Air Defense Battalions." The new units received only overage personnel, although their duties were frequently very onerous. Even the manual labor involved produced unexpected difficulties, for example in the matter of the constant repair and

462 reconstruction of temporary type structures, and the constant movement of the supplies needed for simulated fires to areas devoid of suitable roads. The problem of billeting presented particular difficulties. The temporary nature of the installations to be operated made the provision of bomb proof shelters impossible, but at least fragment proof shelter had to be constructed, in some cases widely distributed over the large areas of the installations involved.

The chain of command was regulated in each case by the responsible air district command. In areas with antiaircraft artillery defenses the commandant of each dummy installation was assigned tactically under the local antiaircraft artillery commander, and this was the usual arrangement. Except in exceptional cases, when the air district command reserved such rights to itself, the antiaircraft artillery officer in

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462 command of the protected target area gave all orders regulating the operation of the dummy installations, including such matters as the ignition and spreading of simulated bomb-caused fires, and in particular the use of simulated enemy signal rockets, stipulating in each case the number, type, and color of the rockets to be fired.

cc. ~~The Effectiveness of Dummy Installations~~. In December 1941 the Office of Military Economy and Armaments issued the following statement:

> During the month under report 8 percent of the high-explosive bombs and 7.4 percent of the incendiary bombs delivered by enemy aircraft on targets within Germany fell on dummy installations; figures for the occupied territories were 2 percent and 1.6 percent. In the month under report the installations were thus not as effective as in the previous months.[600]

In 1942 dummy installations produced conspicuous results, in consequence of which numerous new installations were constructed. Sixty such installations existed alone in the command area of Air District Command III/IV, plus approximately fifty very small installations.[601] Among these the installation northwest of Berlin known as"Super Dummy Installation V 500 (Gross-S-Anlage "V 500")" was of particular significance. The whole complex consisted of twelve sub-installations plus a

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463 dummy airfield and presented an overall appearance of the city of Berlin. For years this complex of dummy installations drew a large percentage of the bombs intended for Berlin. Even in 1944, when the effectiveness of dummy installations had declined seriously everywhere, the presence of Installation V 500 combined with the cleverly directed use of signal rockets continued to divert a considerable percentage of enemy bombs from real targets. One example here is the attack on the night of 7-8 May 1944, when almost the entire load of bombs dropped in a simultaneous mass release by approximately 1 000 bombers fell harmlessly into the sewage farm area north of Berlin.

The worth of dummy installations at the time was computed on the basis of comparisons between the damage done by attacking aircraft and the damage averted through the operation of dummy installations. The factor used to represent the damage which would have been caused if bombs striking the dummy installation had stricken real targets was the mean average value of the actual damage done per bomb by those bombs which landed within the actual target area.

These computations showed that by the end of 1941 the damage averted in Berlin by the operation of dummy installations represented twelve times, in Poelitz twentyseven times the

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463 to cost of construction, upkeep, and operation of the dummy installations involved.[602]

For the month of April 1942 the following figures are available:[603]

Of the total number of bombs delivered on target areas within Germany and in the occupied territories the percentage of hits was as follows for dummy installations and industrial targets:

	Dummy Installations	Industrial Works
Zone of Interior	5.2 percent	4.8 percent
In Occupied territories	5.4 "	6.8 "

On the subject of the effectiveness of dummy installations to protect the Rumanian oil region of Ploesti, the officer at the time in command of the fire police regiment stationed there writes as follows:

> For a long time the extensive artificial dummy installations were of decisive importance. Their construction, outside of the actual oil region, had admittedly cost millions, but they served their purpose excellently, as long as we were only concerned with the Russian air forces as attackers, by misleading the enemy night bombers and causing them to unload their bombs at wrong points. During the critical period between our initial entry into Russia and our capture of the Crimea, these

600. Karlsruhe Document Collection: "Auswirkung feindlicher Luft- und sonstiger Angriffe auf wehrwirtschaftliche Anlagen im Monat Dezember 1941," 2 January 1942.
602. Appendix 9: "Scheinanlagen im Bereich LGK II/IV 1942," 5 January 1942.

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464 dummy installations frustrated all [enemy] efforts to burn out the oil region. The attacks which occurred at the time definitely would have sufficed to achieve this aim if they had stricken Ploesti."[604]

In the occupied western territories only occasional use was made of large-scale dummy installations. In general camouflage measures were considered adequate. Dummy installations were constructed only in cases where the preservation of installations or supplies was of particular military importance.

The first large-scale military dummy installation in the occupied western territories was constructed in Gent by the 15th Motorized Passive Air Defense Battalion, under Major Fuchs, under orders from Air District Command Belgium-Northern France.

The purpose here was to preserve captured fuels for use in the continued German advance.

At an appropriate distance from the fuel tanks, which were the real targets, the battalion used planks to form what would appear as a circular structure when seen from the air. During daylight round wooden objects were covered with canvas given a coating of camouflage paint. In some cases cloth covered wire netting frames were also used for the purpose, the cloth also being covered with a coating of camouflage paint.

602. Karlsruhe Document Collection: "Wirksamkeit der S-Anlagen 1942," by Inspekteur des Luftschutzes, 28 March 1942.
603. Appendix 37: "Uebersicht ueber Luftangriffe und Bombenangriffe im Monat April 1942.
604. Hans Rumpf: Der hochrote Hahn, Verlag E. S. Mittler und Sohn, Da mstadt, 1952, p. 56.

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465 At early dusk the canvas covers were rolled together leaving the dummy tanks open to view. Daylight attacks by bomber units were still unknown at that time, and it was hoped that enemy airmen at night would drop their bombs on these false targets. This actually happened: two large bomber forces in 1940 heavily bombed the dummy fuel tanks, while the real tanks remained completely undamaged.

Besides constructing the dummy installations described above the battalion at the same time had built wooden structures around the real fuel tanks. These structures were also covered with canvas given a coating of camouflage paint.

The largest installation of this type, constructed by the 15th Motorized Passive Air Defense Battalion, protected the oil port of Antwerp-Kiel in the same manner.

In this case the construction of camouflage and dummy installations cost months of labor, since the number of fuel tanks requiring protection was 400. Air District Command Belgium-Northern France had assigned the mission to the 15th Motorized Passive Air Defense Battalion, and the individual companies of the battalion competed against each other in the task.

Dummy installations came into frequent use in French ports along the Atlantic coast, usually to protect fuel tanks.

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465 No information is available on the results achieved.

466 The expendituresin timber and material, and also the other costs, were exceptionally high. However, the installations were a complete success.+ In spite of the enemy air attacks, the fuel storage tanks remained preserved for the German military forces, and their entire contents served the German troops during their continued advance into France.

The use of simulated signal rockets was introduced in 1943. In the spring of that year the enemy commenced their tactics of quick sequences of concentrated large-scale attacks The novel feature in these tactics was the use of Pathfinder units to mark the targets for attack and the concentration of the bomber stream which then followed in attacks lasting only between thirty and forty minutes. To offset the effective target marking carried out by the British Pathfinder planes, the German side developed simulated signal rockets, resembling those used by the Pathfinders, for use in combination with installations to simulate small and large fires at the various dummy installations.

Large area smoke screens and the constantly improved operation of installations to simulate large fires plus the use of simulated enemy signal rockets at the dummy installation

+Apparently the author is referring here to the dummy installations at Gent and Antwerp.

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466 continued to give good results even in the case of daylight attacks in 1943, so that these means of passive defense became indispensable parts of the overall defenses.

Even as late as in early 1944 the various means of passive air defense, such as smoke screening, installations to simulate fires and dummy installations with their simulated signal rocket stations achieved successes throughout Germany.

After the collapse of the German fronts in France in mid-1944 a completely new situation developed for the German home defenses, since the early air warning areas in the west had now been lost, so that it was no longer possible to provide an adequate early warning service for the western areas of Germany. This precluded the successful use of smoke screening and simulated fires at dummy installations.

With improved methods of radar blind navigation (known in Germany as the Diskus method) emphasis in daylight attacks shifted to bad weather periods, which considerably reduced the effectiveness of dummy installations.

Under these circumstances the German High Command with full justification considered the dummy installations in the western territories as outdated. Orders were issued recalling the passive air defense units to the Zone of Interior, with instructions to dismantle the various installations, or at least their most valuable parts. The rest of the inatallations

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467 together with all structures were left to decay.

Some air district commands still continued efforts to deceive enemy reconnaissance units by lighting simulated fires in factories after an abortive enemy attack. the purpose was to give the impression that the factory concerned could be considered as destroyed so that further attacks were unnecessary. These simulated fires were to be lit within the factories concerned.

Air District Command VI, Muenster, for example, issued the following instructions for the continuation of simulated fires in the Rhine-Westphalian insuatrial installations:

(1) During enemy air reconnaissance simulated fires will be maintained inside of particularly important installations which which have escaped destruction or serious damage during previous attacks.

(2) It is of importance to insure quick development of dense smoke and steam. To give the impression of fire-fighting activities, fires will also be maintained which give off white smoke, which can be done by using damp

468 fuels. The fire places will be so situated that they will function no matter what the direction of the wind might be.

(3) The fuel intended for the simulated fires will be stored inside or outside the target premises in such

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468 manner that it will not present a fire hazard endangering the target to be protected.

(4) The preparation and operation of simulated fires will be handled by employees of the target installation.

(5) Once in operation simulated fires will be maintained for not longer than approximately twentyfour hours, since the enemy will be justified in assuming that any fires which might have been caused by attacking aircraft in the installation concerned could be brought under control within that space of time. If new bomber forces are then reported or observed approaching, the simulated fires in protected target installations will not be relit.

This directive could hardly be considered applicable to industries in western Germany because of their short distance behind the fighting front. The expenditures in material and labor would have been disproportionate to the intended results. For this reason the only points in the west at which simulated fires were still used at the end of 1944 were the few dummy installations still in existence. Even there, however, the steady approach of the front soon made it impossible to start simulated fires in time. Furthermore, personnel of the Factory Air Defense System expressed the opinion that simulated fires within factories were likely to enable enemy air reconnaissance by

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469 visual observation and air photography to detect the actual condition of the target concerned and thus result in immediate or later repeat attacks.

A dummy model of the shipyard was built up in the vicinity of Wilhelmshaven, roughly 6 miles northwest of the real shipyard, in the Groden area of the Jade River. This installation actually drew a number of the attacks intended to strike the real shipyard. Furthermore, a number of devices were installed within the shipyard and prot terrain , the purpose being to set them in operation after any bombing attack which might occur in order to mislead enemy air reconnaissance for a period of up to 48 hours concerning the results of the attack. Statements by downed enemy airmen confirm that this purpose was frequently achieved.[605]

According to information from the factory air defense chief of the Gutehoffnungshuette iron works, a dummy installation created to protect the works actually drew a number of bombing attacks from their real target.[606]

In summarizing it can be stated here that in the first years of the war dummy installations achieved quite considerable defensive successes. In this field as in others it was

605. "Werft- und Hafenluftschutz," by Karl Kramp, in "Ziviler Luftschutz," Volumes 6-8, 1955, Verlag Gasschutz und Luftschutz," Koblenz.

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469 a matter of a race between defensive techniques and technology on the one side and the development of tactics of attack on the other.

Whether dummy installations will be of any value and importance in the future is hard to predict. In view of the present possibilities for orientation it would be necessary to devise completely new methods to deceive an enemy.

606. "Der Werkluftschutz der Gutehoffnungshuette Oberhausen AG., 1931-1945," by Erich Stein, 10 January 1956, p. 24. In Karlsruhe Document Collection. See also IV, e, 4, ff, above.

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470 e. ~~Bomb Disposal and Disarming~~.[607]

1. ~~Bomb Developments~~. Before going into the subject of the various methods for disarming dud and delayed action fuze bombs, the following brief description of the bombs used by the enemy is offered, without any treatment of details.

HIGH-EXPLOSIVE OR DEMOLITION BOMBS, 1940-41.

In this class main emphasis was on the general purpose bomb. This was what might be called a standard type of bomb with a thick outer shell of cast steel, approximately 30 percent of its weight being the explosive charge. The usual calibers were 250 and 500 pounds. The fragmentation effect was considerable, but the damage done by these bombs was relatively negligible.

1942 witnessed a marked increase in the effectiveness of these bombs. The new bomb was the British High Capacity bomb, with calibers between 2000 and 4000 pounds. This bomb was of the air mine type, having a thin outer casing, with its explosive charge making up approximately 80 percent of its total weight. Its effects were annihilating within a large radius. When first introduced its use resulted in the destruction of entire city districts, as was the case in Luebeck, Rostock, Cologne, and Essen. Its effects were increased by the

607. More details will be found in Appendix 38: "Bombenentwicklung, Blindgaenger-Raeumung und Langzeitzuenderentschaerfung," by Walter Merz, 1956, which includes construction diagrams and photos.

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470 simultaneous release of incendiary bombs.

The final and most decisive type of air mine bombs came into use in 1943 and 1944.

The US Air Force in these two years used Type Demo 500 and Demo 100 pound bombs,

The British Royal Air Force used Medium Capacity 500 and 1000 pound bombs.

Because of their effectiveness both the Demo and Medium Capacity types remained in use up to the end of the war. Combined with incendiary bombs meanwhile developed to the highest possible stage of perfection, these bombs wrought the greatest havoc in the annals of history.

In 1945 rocket type bombs still had a strong influence on morale and had great destructive capacities.

Of the numerous special type bombs used only the following are mentioned briefly here:

HC 12 000 pound bombs, which destroyed the viaduct at Bielefeld.

8 500 pound (3900 kilogram) rotating water bombs used to destroy valley dams.

AP 13 500 pound bombs, which were armor piercing bombs with peak performances. The impact of this bomb was increased by especially powerful rocket attachments.

GP 2000 pound (US type) glide bombs.

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471 INCENDIARY BOMBS[608]

It is necessary here to differentiate between four main categories:

(1) Electron Stick-Type Incendiary Bombs. In some cases these had an explosive disintegrator. They were released in containers, and at altitudes between 2600 and 4000 feet the containers opened and spread their contents over a wide area.

(2) Liquid Incendiary Bombs. These were used in calibers between 100 and 500 pounds and usually contained gasolin, waste oil, and metallic magnesium.

(3) Phosphorus Bombs. These contained an incendiary compound of dissolved rubber. An explosive disintegrator charge spread the phosphorus-ignited rubber solution over an area approximately 44 yards in diameter.

(4) Fire Jet Bombs. For a period of four minutes this bomb changed its position repeatedly after striking. In this way it sprayed the surrounding area with a jet of flame to a distance of between 10 and 16 feet. The bomb was designated J-30 Lb, and had a weight of approximately 30 pounds.

BOMB DETONATORS OR FUZES.

The bomb detonators used by Germany's opponents can be classified in the following six groups:

608. For more details see Appendix 38.
609. Ibid.

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472 (1) Mechanical impact detonators

(2) Pyrotechnical detonators

(3) Air pressure detonators

(4) Hydraulic pressure detonators

(5) Mechanical or chemical delayed action fuzes

(6) Electrical detonators.

Detonators were built into the nose, rear, or side casing of the bombs.

The most important of the above six groups was that ot the delayed-action type of fuze. In a deadly fight against time a bitter struggle was waged between the constructors of these fuzes,on the one hand, who racked their brain to devise ever new means to prevent any disarming of these fuzes, and the German experts on the other hand, who in their selfsacrificing work endeavored to find methods to render harmless each new type of fuze as soon as it appeared in use.

The Anglo-American delayed-action fuzes are of the chemical ignition type. When the bomb is released the revolutions of a propellor set a spindle in motion which breaks an ampulla containing acetone. A powerful spring detonator hammer is held in place by a celluloid disc when set . The aceton disintegrates the celluloid and releases the hammer spring. Timing is determined by the acid concentration and the thickness of the celluloid disc.

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473 With the exception of those termed "short-delay fuses (Kurzlaeufer), which have a delayed action between 30 and 120 minutes, delayed-action fuzes are provided with devices to prevent their removal, so-called booby traps. These are mechanical contraptions which become effective when the fuze is being removed and detonate the bomb.[610]

In addition to its delayed-action fuze, the bomb had a tumbler detonator designed to render it sensitive to jolts or turning.

Altogether approximately 400 different types of bomb detonators were identified. This figure alone is sufficient to judge the giant task facing those whose mission it was to render harmless and remove bombs of all types.

THE INVESTIGATION OF NEWLY INTRODUCED TYPES OF BOMBS!

Whenever the appearance of a new type of bomb used in an air attack was reported, the Reich Institute of the Air Force for Passive Air Defense immediately dispatched experts to the scene to initiate the first measures. Whenever possible intact parts of the new bomb were forwarded to the Institute for research and for development of the best methods of disposal of such bombs. This work the Institute carried on in cooperation with the Reich Chemo-Technical Institute and all other agencies

610. Appendix 38.

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473 which might be of assistance.[611] As soon as appropriate methods for disposal had been developed, these were demonstrated at the Institute before representatives from the appropriate command authorities.[612]

474 2. Bomb Disarming Methods. In disposing of dud and delayed-action bombs, the most important first requirement was recognition of the type of fuze involved. All other measures, including the decision as to the correct method of disarming as well as the necessary precautions such as closing off the area, were determined by this point.

In the first years of the war a wide variety of methods were employed for the disposal of dud bombs , and heavy losses ocurred in a race against the inventive genius of the opponent.

On the basis of practical experience in the subject Air Field Manual L. Dv. 764: "Removal of Enemy Dud Bombs (Beseitigung Blindgaenger feindlicher Abwurfmunition)" was issued with a number of annexes and instructional pamphlets numbered 1-10. Supplementary sheets issued continuously served to keep abreast of current technical developments in the field.[613]

Four priority stages were established to determine the sequence of bomb disposal operations, as follows:

Stage A: Immediate removal required. This applied when vital military interests were involved.

Stage B: To follow Stage A. This applied when

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474 operations required under Stage A were completed.

Stage C: Disposal operations not necessary before 72 hours. This applied when no grave personal risks were involved.

Stage D: Disposal when convenient.

As a rule one of the following three methods was used in the first years of the war:

(1) The steam method, after a hole had been bored through the casing.

(2) The burning out method, using thermite for the purpose.

(3) The partial blasting method.

475 Later in the war, as routine improved, the only method applied in the case of duds was that of disarming, meaning the removal of the vital element of the bomb, its detonator. The masses of bombs dropped, particularly by the US Air Forces, precluded any possibility for complicated and lengthy procedures. The all important point was to restore manufacturing processes and traffic movements to operability as speedily as possible, even at the calculated risk of increased casualties.

The Stuttgart Method of Bomb Disposal. This method was

611. Karlsruhe Document Collection: "Wirkung feindlicher Brandbomben," Report notes, Passive Air Defense Inspectorate, 28 March 1942. Offered here as an example.
612. Ibid: "Vorfuehrung neuartiger Geraete zur Blindgaengerbeseitigung in der Reichsanstalt der Luftwaffe fuer Luftschutz. 2 photstat copies.
613. Karlsruhe Document Collection.

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475 generally used for US delayed-action bomb fuzes of the M 123, 124, and 125 types.[614]

~~The Duesseldorf Method~~ . This method was developed and used for British delayed-action fuze bombs of the 37 MK IV (WeCo) type with anti-fuze-removal devices, unless the DM-Equipment developed by the Navy for this purpose was used.

~~The Duisburg Method~~. This method was to be applied when it was ascertained that a bomb had a type 37 MK IV dxlayed-action fuze combined with Type 845 electrical tumble detonator.

Finally, it is necessary to mention the ~~Ratingen Method~~, used to disarm British No.17 type delayed-action fuzes.

The above cursory review of a few of the more important methods developed by fearless bomb disposal personnel in their self-sacrificing mission can naturally convey only a very incomplete picture of this branch of passive air defense, which was of such imminent importance for the preservation of the national war potential.

476 3. ~~The Locating and Uncovering of Dud Bombs~~. Immediately after each air attack the local passive air defense chief reported through the appropriate air district command or directly to the bomb disposal squads any points of impact by dud or de-

614. See Appendix 38 for a description of the methods of bomb disposal listed here.

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476 delayed-action fuze bombs reported to him. The depth to which a bomb penetrated naturally depended on various factors. If it was assumed to be at a medium depth , efforts were first made to locate it by "feeling" for it with thin steel rods.

A more complicated matter was that of digging out bombs which had penetrated deeply. The digging took up a lot of time. Furthermore, a bomb after impact travelled some distance under ground, this distance and the direction depending on the condition of the ground and the force of impact, as well as the angle of impact. This made it necessary to sink a number of holes.

The physical research and other institutes instructed by the Reich Minister for Aviation and Commandxr in Chief of the Air Force, through Air Force Inspectorate 13, to develop locating instruments for the purpose, failed to develop ready for production a model which would have met all requirements in practical use.[615] The bomb disposal squads therefore constructed a waterjet feeler sonde (Spuelsonde) for the purpose. This instrument consisted of a thin steel pipe with a removable jet point. With a water pressure of 8 atmospheres (112 pound per square inch), it was possible with this instrument to probe into the ground without any effort. Initially it was not pos-

615. For more details see Appendix 38.

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476 possible to determine whether an obstruction encountered underground was a bomb or a stone. Later a second jet spray was attached to the point, and an electric current from a torchlight battery made it possible to determine whether the obstruction was stone or metal.

477 Owing to the high sensivity of most types of bomb detonators to vibration, it was not possible to use mechanical equipment to dig out the bombs. For reasons of safety this had to be done by hand. Here again it was the inventiveness of the bomb disposal squads which developed a time-saving method, namely the use of well ring sections.

With the increasing volume of bombing during the war it became necessary to relieve the already excessive strain on the existing bomb disposal squads.[616]

It happened on a number of occasions that after air attacks British 30-pound phosphorus incendiary bombs, light-signal, and flash-light bombs, oxygen containers, etc., were regarded by observers as delayed-action fuze bombs and reported to air district command headquarters for immediate removal by bomb disposal squads. This resulted in unnecessary traffic halts and diversions, which were particularly serious in militarily important factories, etc., and traffic installations, and unnecessarily increased the burden on the bomb disposal squads.

616. See V, d, above.

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477 For the above reasons the Reich Minister for Aviation and Commander in Chief of the Air Forceon 29 June 1943 ordered that a certain percentage of all personnel in the local passive air defense forces, in military installations, in the Passive Air Defense Police, and in the Factory Air Defense System, as well as in installations of the special administrations were to receive instruction on the re ognition of the impact of unexploded bombs of all types in order to insure proper reporting to the local passive air defense authorities and to the bomb disposal squads.

As a further measure to relieve the strain on the bomb disposal squads, the same personnel were to receive training enabling them to disarm enemy incendiary bombs, such as stick-type, fluid, and phosphorus bombs, fire leaves, etc.

478 The actual removal and disposal of unexploded demolition and mine-type bombs, and of flash light and signal bombs, however, remained a responsibility of the locally responsible bomb disposal squads.

The training required under the abovementioned order was given to the designated personnel within the individual air district commands, the various subjects being handled by the appropriate schools there.

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479 IX. THE IMPACT AND CONSEQUENCES OF THE AIR WARFARE CONDUCTED AGAINST GERMANY.

For an appraisal of the impact of the Allied air attacks against targets in Germany is is necessary first to consider the chronological sequence of events.

a. ~~Chronological Development~~. The "strategic air offensive" against Germany, conducted initially by the Royal Air Force alone, commenced on 11 May 1940.[617] From then on the German Armed Forces High Command Bulletin (OKW-Bericht) almost daily reported night attacks by British aircraft against various towns in western Germany. During the early stages these attacks were not very effective. Due to the precautionary passive air defense measures introduced, it was possible to restrict the damage done or to repair it within a relatively short time. An English report contains a complete summary of the sequence of air attacks carried out.[618]

Up to the end of 1943 there was no evidence that the results of air warfare could decide the outcome of the war. The nature and intensity of overall warfare, however, were strongly influenced by air warfare.[619]

At the Casablanca Conference the directive was issued requiring

"....the progressive destruction and dislocation of the German military and economic systems, and the under-

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479 undermining of the morale of the German Nation.[620]

This directive was followed in 1943 by a markedly noticeable and steadily mounting offensive activity on the part of the Allies. A chronological review of the increasing intensity of the war by air is given in Appendix 41.[621]

The "Point Blank" offensive opened early in the spring of 1943 and came to a temporary halt in April 1944, when both the US and British heavy bomber forces were placed under control by the Supreme Commander, Allied Expeditionary Forces, for the duration of the invasion operations.[622] According to one source dated 7 December 1943 167 230 tons of bombs had been dropped on 38 large cities by the end of October of that year. These operations were conducted under a plan ".....according to which those German towns which had the largest population were attacked."[623] In view of the inadequate results achieved the Combined Operational Planning Committee stated

> .....that it was a more effective strategy to concentrate against cities containing vitally important industrial targets. The best way to achieve this was that of destroying the homes of the workers emplpyed in the German industry.[624]

It would exceed the scope of this study to enter into details on individual large attacks. From the wealth of material

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617. British Air Marshal I. M. Spaight in his book "Bombing vindicated," London 1944, gives the 11 May 1940 as the historical date ".....on which we opened our strategic air offensive against the Reich."

618. Karlsruhe Document Collection: Milestones of Strategic Bombing.

619. Karlsruhe Document Collection: "~~Luftschutz und Luftkrieg~~-fuehrung," which is part of a study by Branch 8, Chief, Luftwaffe General Staff, 1 January 1943, p. 7.

620. Karlsruhe Document Collection: Translation from "The Royal Air Force 1939-45," Volume III, "The Battle is Won," by Hilary St. George Saunders, p. 1.

621. "Zeittafel der Steigerung des Luftkrieges besonders ueber Deutschland 1943-45," in Hans Rumpf, "~~Der Hochrote Hahn~~," Verlag E. S. Mittler und Sohn, Darmstadt, 1954. See photostat copy of pp. 154-159 in Appendix 39.

622, See source quoted in Footnote 633, p. 60.

623. Ibid, pp. 63, 64.

624. Ibid, p. 64.

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published on the subjectonly a few typical cases will be referred

481 to here without any intent to establish a sequence of importance by the selection.

A very graphic description of the impact of air attacks on German cities and industrial centers is given by Hans Rumpf in his work "Der hochrote Hahn," mentioned previously in Footnote 604, above. The reader is referred particularly to the attacks against cities like Hamburg, Leipzig,[626] and Dresden (p. 133)[627], models of inhuman air warfare without strategic value, Cologne,[628] and Berlin.[629]

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625. Writing as an expert on his subject (Hans Rumpf was formerly Inspector General of Firefighting Services) the author describes the course and effects of the attacks. He admittedly restricts himself to the operations of the fire police, without enlarging on the very important activities of the passive air defense troops.

626. See also "Terrorangroffe auf das Stadtgebiet Hamburg in der Zeit vom 25. 7.-3.8.1943, by Oberst von Pidoll, CO, 2d Passive Air Defense Regiment, in Karlsruhe Document Collection. See also Footnote 441, above and p. below.

627. What merits special mention here as a particularly significant case is the repetition of the attack, with demolition bombs and weapons fire, against the population, whose numbers were increased by hundreds of thousands of refugees, who had crowded to the meadows along the Elbe River following the major attack which had occurred during the night. See also Rumpf pp. 133-134.

628. Karlsruhe Document Collection: "~~Koeln im Luftkrieg~~," Statistische Mitteilungen der Stadt Koeln, 9. Jahrgang, 1954, Heft 2; Photostat copy of parts of an article in the journal Wochenend;" "Der Weg durch das Feuer," an illustrated factual report on 1939-1945, distributed by M. Dumont Schauburg, Koeln, Pressehaus.

629. Karlsruhe Document Collection: "Luftangriffe auf Berlin in den Jahren 1943-45," a concise compilation from notes from Berlin.

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482 According to the stastics of the Allied Bombing Command a total of 45 517 tons of bombs were delivered on Berlin in 363 air attacks, 40 of them major attacks by forces larger than 1 000 bombers. Berlin was thus the most bombed city in Germany, followed by

Essen (36 420 tons), Cologne (34 711 tons), Duisburg (30 025 tons), Hamburg 22 850 tons), Dortmund (22 424 tons), Stuttgart (21 016 tons).[630]

Hans Rumpf estimated the number of casualties inflicted by air attacks in Berlin at approximately 22 000.

This would be 0.8 percent of the population, reduced through evacuations from 4.5 to 2.8 millions, in the last 2.5 years of the war, who lived through the bombings in the capital city of Germany. This figure is lower than the 1.3 percent of the civilian population killed in 40 Ruhr region cities according to computations. It speaks volumes for the excellently functioning protective measures taken,
taken, particularly those of a structural nature, and for the excellent air discipline of the population of Berlin, the majority of whom had to rely on their makeshift cellar shelters, since only a small percentage of them could find complete protection in bomb proof bunkers.[630]

630. The above figures and quotation are from an article by Hans Rumpf: "Berlin im Bombernkrieg 1940-45," in "Ziviler Luftschutz," Verlag Gasschutz und Luftschutz, Koblenz Volumes 2 and 3.

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482 The effective loss of homes is estimated at 50 percent, and according to figures registered by the Allies more than 65 percent of all industrial installations in Berlin were in operable condition at the end of the war.[630]

The loss in works of culture is irreparable.

483 It is impossible to recount individually the numerous other townsattacked and to go into the effects of the attacks. Only one other example will be quoted here, that of Pforzheim, where 20 000 out of the 80 000 inhabitants lost their lives in one single attack.[631]

By the end of the war the US Air Forces delivered more than 1 000 000 tons of bombs over Germany, while the Royal Air Force delivered a total of "only" 955 044 tons, of which more than 500 000 struck residential districts.[632]

The after-action final report on activities of the Anglo-American air forces during World War II, published in Washington in October 1945, gives the following information:

In 1 440 000 bombermissions over Germany the number of bombs dropped was 2 700 000.320 German towns came under attack, 3 600 000 buildings were destroyed or badly damaged, and at the end of the war 7 500 000 Germans

631. Karlsruhe Document Collection: "~~Auch Pforzheim musste~~ buessen," typewritted copy from the journal "Wochenend."
632. Karlsruhe Document Collection: "~~Einsatz der Alliierten~~-- continued.

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483 had become homeless through the air attacks.[633]

484 b. Impact of the Air Attacks on Industry and Traffic.

The German military potential was necessarily subject to limitations because of such factors as the massed concentration of the various branches of industry, the sensitivity of individual factories and other installations to air attack, the susceptibility of the whole communications and traffic system to interference, the bottlenecks in numerous fields of supply, the electric power supply situation, and the fact that certain essential raw materials were in short supply.

In the following passages an effort will be made to present a short review of the impact of the air offensive on the most important manufacturing or otherwise producing and storage centers of the armament industries and the war economy in general, as well as on the communications and traffic systems.

In general it can be stated that the German armament industry stood the test of war well owing to the passive air defense prepared in advance and constantly improved during the war.

A large number of armament works admittedly had been struck, but so far as the actual condition of the

632--Continued: Luftwaffen gegen deutsches Reichsgebiet," excerpt from an article "Feuer fiel vom Himmel," by Dr. Karl Bartz in "Illustrierte Woche," No. 5, 29 January 1955.

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483 industries supporting the military effort was concerned, the overall potential was far less weakened than the opponents assumed.

Admittedly numerous works were rendered temporarily inoperable, but ~~frequently~~ it was the building which were damaged, and these were soon repaired, more frequently than the machinery and installations.[634]

Relocation and decentralization measures made it possible to maintain industrial output at the necessary level up to 1943, in some cases right up to the end of 1944. As an example, a report by the Military Economy and Armaments Office dated 2 January 1943 is quoted here.[635]

A recent publication by Dr. Theo Weber gives highly illuminating information, based on authentic figures, on the subject of the outcome of unlimited air warfare against Germany.[636] Particularly interesting features in his work are as follows:

(1) Taking as a basic factor the total quantity of bombs delivered by the Allies over Germany (roughly 1 500 000 tons) compared with the total of roughly 56 000 tons delivered in German attacks over Britain, it is found that the ratio of bomb-tons to persons killed was 3:1 in Germany compared to 1:1 in Britain. This

633. Karlsruhe Document Collection: "~~Einsatz der anglo-amerikanischen Luftwaffe ueber Deutschland~~."

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485 circumstance undoubtedly must be attributed to the high standards of German passive air defense activities.

(2) ~~Mining and Steel Production~~. Not a single pithead tower was destroyed in Germany by bombs. In the case of the Krupp Works, Essen, the maximum total damage done to buildings was 65 percent. In spite of the numerous attacks directed against Krupp, Essen, only 180 persons were killed and 300 injured by bombing attacks out of the 75 000 personnel employed.

(3) According to all information presently available, the Buna synthetic rubber works at Huels and Schkopau, the latter employing 10 000 workers, remained operable right up to the end of the war.

(4) Of the large rubber tire manufacturing works, the Continental Rubber Works in Hannover were damaged by bombs. However, this factory was already able to produce 50 000 motor vehicle tires in the first year after the war ended. In all other rubber manufacturing and processing works output also kept pace with consumption.

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634. "Der hochrote Hahn," Hans Rumpf, Verlag Mittler und Sohn, Darmstatt, 1952, p. 114.

635. Karlsruhe Document Collection: "~~Auswirkung feindlicher Luft- und sonstiger Angriffe auf wehrwirtschaftlich wichtige Anlagen im Monat Dezember 1941~~," 2 January 1942.

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486 The means, the expedients, and the improvizations used in efforts to maintain the output of the armament industries under the increasing severity of the air situation are revealed by the summary reports submitted at regular intervals by the Armaments Committee (Rüestungsstab) to Field Marshal Milch.[637]

According to the current production and transportation situation, the measures taken included the ~~the~~ following:

A freeze on certain categories of building construction projects;

The movement of labor from certain concerns for reallocation;

Transportation restrictions;

The regroupment of available transportation space;

Promotion of "small package" (Rucksacktransporte) transportation;

Control of electricity consumption.

In selfsacrificing efforts everything humanly possible was done until the withdrawal of the German fronts and the complete paralyzation of the transportation system brought about the end.

636. "Die Bilanz des Uneingeschraenkten Luftkrieges gegen Deutschland 1942-1945--Bemerkungen zu einem Buch von Hans Rumpf: 'Der hochrote Hahn, die Zeit der grossen Feuerschlaege," by Dr. Theo Weber in 'Flugwehr und Technik," Volumes 6-9 1955. Photostat copy in Karlsruhe Document Collection.

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487 In the future control plans will have to be included from the outset in all production planning.

The following are some of the branches of armament and general wartime industries on which the impact of air attacks was particularly evident:

(1) The Aircraft Manufacturing Industry.[638] The Chief of Staff, Allied Air Forces held the opinion that in the first phase of the Point Blank Offensive

> .....that the German output of single-engine fighters was reduced to about 40 percent below the planned number.[639]

Compared with the figure of 595 fighters estimated by the Allies, the actual output in the first half of 1943 was 753; in the second half of the year it was 851 against the estimated 645. In 1944 the increase was even more pronounced, and in 1945 output at the beginning of the year was 1 581 against an estimated 655.

The reason for the above was the quick expansion and decentralization of the manufacturing works, but in even greater measure was due to the efforts of Fighter Production

637. For an example see Karlsruhe Document Collection: "Auswirkungen der alliierten Luftangriffe Ende 1944-Anfang 1945 auf das deutsche Transportwesen." ".....auf das deutsche Bauwesen," and ".....auf die Energiewirtschaft", from Summary Report to Field Marshal Milch, 8 June 1956K.

638. See also IV, e, above and Karlsruhe Document Collection: "Auswirkungen der Bombenangriffe auf die Messerschmitt-Werke 1943," Conference Notes.

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487 Staff established under direction by Reich Minister Speer in February 1944.[640]

The situation of the German aircraft manufacturing industry and of the German Air Force nevertheless remained exceedingly difficult. Aircraft were being destroyed on the ground at airfields almost as fast as they could be manufactured. The point of decisive importance, however, was the increasingly acute shortage of fuel.

(2) ~~The Fuel Supply Situation~~. After the loss of outside oil regions, the German hydrogenation installations became of paramount importance. Any interference with production here was bound to have adverse repercussions on the military and on the entire war industry. To increase the number of hydrogenation plants already in existence was not longer practically possible. Apart from active air defense, the use of dummy installations in the first years of the war did much to protect the existing installations by decoying attacking enemy air units, as had been the case formerly with the Rumanian oil regions,[641] Later, their effectiveness decreased markedly as a result of improving methods of orientation.

639. See Footnote 623, above.
640. IV, e, 4, ee, above. See also Karlsruhe Document Collection: "Auszug aus einer Ausarbeitung der 8. Abt. des ~~Generalstabes (Kriegsgeschichtliche Abteilung) ueber Erhard Milch~~.
641. See III, f, and V, a, 3, above.

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488 For a while it was possible to compensate for reduced output to some extent by drawing on the reserves held in bulk storage depots. The existing sixteen depots of this type were still operating at full capacity in March-April 1944. Then, however, these capacities dropped with swift suddenness when the series of large-scale and systematic attacks against hydrogenation plants and bulk storage depots commenced. Output dropped steadily to a level of between 10 000 and 20 000 tons monthly, compared with a maximum consumption figure of 250 000 tons per month in the spring of 1944.

Fuel shortages also seriously hampered pilot training activities in the last years of the war, quite apart from the hampering effect these shortages had on the entire armament industry and the supporting communications and transport services.[642]

(3) The Ball Bearing Manufacturing Industry. The output in ball bearings had always been a bottleneck in general industrial activities. The main manufacturing center for ball bearings in Germany was Schweinfurt with its five factories engaged in this field. In spite of the air attacks
489 which had occurred on 17 August and 14 October 1943 nothing had been done to relocate this "key" industry. Now every

642. Footnote 623, above.

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489 possible means of passive air defense was introduced to protect the works. A special commissioner was appointed to control the production, and industrial concerns received instructions to dispense with ball bearings wherever possible. The measures thus taken produced the desired results. No serious disruptions occurred: the 15 percent by which the attacks had reduced the output was not serious enough to have any decisive impact. The large-scale attacks on 24 and 25 February 1944 came too late. Relocation measures had served meanwhile to reduce ball bearing manufacturing installations in Schweinfurt by about 40 percent, and the 8 percent destruction and 7.5 percent damege done to those still in the town hardly represented a worthwhile attack achievement.

According to a German report at the time, not a single item of equipment was subject to reduced output because of a shortage in ball bearings.[643]

4. ~~Communications and Traffic~~. The passive air defense measures taken by the administrations of the various media of transportation proved adequate as long as air attacks remained within moderate bounds. Concentrated attacks against traffic bottlenecks admittedly resulted in traffic halts. One result here was that the output of subsidiary industries failed to reach the appropriate manufacturing centers in time, another was that

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489 was that transportation vehicles, already in short supply, remained inactive for weeks at a time, and this produced a general feeling of uncertainty on the possibility to meet delivery deadlines.

The innumerable possibilities to reroute traffic in many cases made it possible to relieve the situation to some extent. Finally, however, large-scale destruction, such as that of the Mittelland Canal,[644] or of marshalling yards in western Germany, could not be remedied and necessarily had a paralyzing impact on the entire economy. More details on this subject will be found in the section of this study dealing with passive air defense in the special administrations.[645]

5. ~~General~~.

The picture only becomes complete when one bears in mind that at the same time, or in a constant sequence and without exception, all elements of the economy and the transportation system were stricken, as for example, coal and metal mines, iron works; foundries; valley dams; aircraft factories; shipyards; tank factories; subsidiary factories; electric power stations; repair shops; the entire railway system together with its installations, its locomotive and other rolling stock; bridges, port installations; the most important administrative buildings of the

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490 authorities responsible for direction of the overall war effort; the research and proving stations; airfields;and depots. The same thing applied to all of them: in spite of almost incredible performances in the repair of installations and action to restore manufacturing capabilities, attrition continued at a growing pace. This meant that even minimum subsistence supplies to the civilian population, current supplies to the military forces, gradually became disrupted and later in some cases even ceased altogether, namely in cases where in spite of all endeavors no more substitutes could be found and the articles still being forced out of production were neither complete nor fit for transportation.

The back of the war effort had finally been broken, and in consequence the combat efforts of the troops were denied success, so that lost ground and withdrawals reduced the territory steadily in which the "economic effort" was exhausting itself against overwhelming forces, andwith the concurrent result that the steadily shrinking area available was battered even more severely than ever before."[646]

643. See Footnote 623, above; see also III, b, and III, c, above.
644. Appendix 26 (air photo).
645. See IV, f, 1, 2, 3, 4, 5, 6, and 6 aa, bb, cc, above.
646. Karlsruhe Document Collection: "Heimat Verteidigung,"Lecture by General Doerstling at the Air University, Fort Maxwell, Montgomery, Alabama, in June 1955, pp.27-28.

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491 A compilation of the effects of air attacks on the German economy will be found in the study included with the present study as an appendix.[647] It deals with the following subjects:

Traffic paralyzation
Coal production
Steel production
Agriculture and the food situation
The fuel supply situation 1939-45
Aircraft production.

A study by Branch 8, Chief of the Air Force General Staff on 7 December 1944 culminates with the demand:[648]

> Within a few decades Europe will have to be an air fortress garrisoned by workers, farmers, and soldiers, and in which only those who work and fight will have any right to live--otherwise it will not survive the Twentieth Century.

The paralyzation of traffic and of the materiel potential of the German war industries cr ated conditions which deprived even a population willing to resist to the end of all possibilities to produce what was necessary for continuation of the war.

Any future war of long duration will place similar

647. Appendix 40: "~~Die Auswirkungen des Luftkrieges auf die~~ deutsche Wirtschaft," based on a study Branch 8 of the Air Force General Staff, using official figures, in late autumn 1944.
648. Karlsruhe Document Collection: "~~Folgerungen fuer die Struktur des Wirtschaftslebens aus den bisherigen Kriegs-~~erfahrungen," study by Branch 8, Air Force General Staff, 7 December 1944.

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492 strains on the capabilities of all potentials in a measure that, in view of the considerably increased effectiveness of more modern weapons, will exceed the resources even of economically independent nations. No matter how excellent the performances of their military forces, even such nations will not be able to so supply their forces that they will be able to sustain combat indefinitely.

c. The German Civilian Population in Air Warfare. The psychological and mental behavior of the population of a country at war is a factor of decisive importance for success or failure. Fully confident of the justice of its cause the German Nationcourageously and without flinching bore the hardships of the first years of air warfare. In the beginning the series of attacks remained locally restricted.

Later, when the phase of large-scale attacks commenced and the population left alive in the town districts destroyed by mass bombing experienced the unspeakable horrors of indescribable scenes and also themselves experienced inconceivable hardships, moments of weakening were noticeable inisolated cases. On the whole, however, it can be said that a spirit
493 of tenacious resistance and of willingness to make sacrifices continued up to the end. No signs of disintegration became evident. The German population proved worthy in their behavior and bore all terrors with stoical courage.

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493 On the whole, the mounting severity of daytime attacks in 1943 did not affect the civilian population as seriously as the night attacks with the ever recurring interruptions of the night's rest. Another factor here was that the American daylight bombers used less incendiary bombs than the British, and quite clearly at that time were still concentrating their attack on industrial targets.

When at the end of 1943 the attacks increased still further in severity, with mine-type bombs and demolition bombs of the heaviest calibers penetrating through to the lower floors of houses and even to the cellars, in many cases burying people under the debris, and when it became ever more and more difficult to cope with the heavy caliber incendiary bombs, confidence in private cellar air raid shelters declined steadily. More and more people sought protection in the public bunker type shelters. This circumstance and the large numbers of people evacuated on a voluntary basis[649] left most houses empty, so that fires could not be extinguished before they could spread.

By the end of 1944 the nerves of the population in general were stretched to breaking point by the heavy losses incurred, the critical situation on all fronts, inadequate food, and the strain of continuous daylight and night attacks, air alerts

649. See IV, m, above.

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493 recurring as many as three or four time daily.

Under the impression of the calamitous fires, in some cases out of fear of being trapped by the flames, in other cases out of a feeling of helpless resignation, the population in some of the most heavily stricken districts simply gave up all efforts to continue resistance.

The tactics of mixed bombing, with demolition and incendiary bombs, had proved to be the most terrifying type of attack against towns. The sufferings of the population under such attacks reached the limits of endurance. The reader is referred here to the examples of Hamburg,[650] Dresden,[651] and Cologne.[652]

Nevertheless, the spirit of resistance remained unimpairid on the whole.

The general firmness of heart and the courage of the German population definitely were not broken, and they continued to work with an energy born of desparation, trying to increase the monthly output figures.[653]

Special mention is due here to the morale of the population of Berlin. By mid-January 1945 Berlin had suffered 17 000 sizable and large bombing attacks, not counting the medium and small sized attacks. Practically 75 percent of

650. See pp. 665, above (p. 481 of German text).
651. Ibid. 652. Ibid
653. Royal Air Force 1939-1945, Volume III: The Battle is Won, Hilary St. George Saunders, p. 69 (Translation in Karlsruhe Document Collection).

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494 the Berlin population held out in their capital city right up to the bitter end, the most of them living under indescribably primitive conditions. At that time already 40 out of every hundred families had lost everything they had ever possessed.

For months they went through an unhealthy life in cellars, sleepless, poorly nourished, with poor services, exposed to cold and damp, and without lighting or heating in the midst of what had formerly been their homes, areas which the bombs had long since turned into desolation

Nevertheless they continued working, everyone at his or her appointed place, without any regular means of conveyance, and kept the giant city functioning up to and beyond the very last day of the war.

Completely exhausted but unbroken in spirit, the civilian population amidst their ruins defied fate, since nothing could alter their circumstances--whether they laughed or wailed, they had to continue living and everyone of them did it according to his gifts.[654]

As a writer on the Allied side puts it:

At no time did the people of Berlin seem for a moment to lose heart during their trial by fire, and they continued to the very end with th exercise their sarcastic kind of humor at the expense of their defenders.[655]

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495 654. "Der hochrote Hahn," Hans Rumpf, Verlag E. S. Mittler und Sohn, Darmstadt, 1952, p. 139.

655. See source quoted in Footnote 623, p. 47.

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496 d. German Civilian Casualties through Air Warfare. The final report published in Washington in October 1945 on the operations of the Anglo-American air forces over Germany during the war[656] states "Through Allied air attacks 1 080 000 civilians were killed or injured in Germany."

It will never be possible to determine precisely the number of casualties actually inflicted by air warfare, In the first years of the war it was still possible for the Registrar Offices to register those killed. Later it was completely impossible to determine the number of the population in the various towns and other communities, some of the original inhabitants having moved to other parts, while refugees fleeing under severe privations and at a heavy cost in lives from the eastern territories had crowded into the central parts of Germany. Furthermore, wherever efforts were made during the war to keep proper records, these were finally destroyed in air attacks or were seized by the victors in the general confiscation of documents.[657] Attempts made by a number of individual towns probably will arrive at fairly accurate figures,[658] but for the whole of the former German territories it will be necessary to rely on estimates based on experience

656. See Footnote to Foreword.
657. Appendix 41: Copy of "Die Verluste der Westdeutschen Zivilbevoelkerung im Luftkrieg," by Hans Rumpf in Wehrwissenschaftliche Rundschau, October 1953, Vol.10, pp.493-7.
658. See annex to article quoted in Footnote 657, above.

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496 factors. These estimates fluctuate widely. Exaggerated initially under the influence of shock, influenced by rumors, the numbers were first reduced after a preliminary scrutiny of official records still available, but then increased again after revision by expert personnel. Probably the most reliable estimate is that by Hans Rumpf,[659] which is based on official records and statistical evidence and gives a figure of 450 000 civilians killed by enemy air action. This figure does not include members of the armed forces, the regular or fire police forces, aliens, or prisoners of war.

The loss ratio differed very widely between the individual regions, as will be seen from the following quotation:

> The number of authenticated deaths due to enemy air action is 37 554 is around 3000 higher than that for the whole of Bavaria. The ratio of killed per 1 000 of the population in Bavaria was 4.3, in Hamburg 22.1. In the most badly stricken part of Hamburg, the central district, which in 1939 had a population of 436 000, the ratio was as high as 59.6 per 1 000, the heaviest ratio of losses per 1 000 for any town district in Germany. Next in order of magnitude were Darmstadt (49.3), Kassel (43.3), and Wuerzburg (43.3).[660]

659. See Appendix 41, p. 8.
660. Ibid, p. 11.

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498 A bulletin issued by the present Federal Government of Western Germany on 3 April 1953[661] estimates the number of civilians killed by enemy air action at 500 000, with the qualifying statement that this figure includes only those killed in the four zones of occupation, and not those killed in the territories east of the Oder-Neisse River line. The same bulletin estimates the total number of German civilians killed by enemy action, deportation, etc., at more than 3 000 000, an awful reckoning!

The extent to which precautionary passive air defense measures applied wisely in advanceand a speedy application of all current experience made it possible to reduce losses among the civilian population is illustrated by the following examples:[662]

~~Bremen~~. In 173 air attacks Allied forces delivered 41 600 tons of demolition bombs and 850 000 incendiary bombs on targets in this city. These attacks destroyed 50 percent of the city but killed only 0.8 per- of the population. With the increasing severity of air attacks the loss percentage, in human lives, even decreased.

~~Mannheim~~. Here also,air attacks destroyed 50 percent of the city, but casualties were even lower, namely 0.7 percent.

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498 Ulm. Here 700 civilians lost their lives in the heavy air attacks of December 1944. Thereupon one-third of the population left the city, and a renewed attack, as severe as the former, resulted in 472 deaths on 1 March 1945. After this, the population was reduced to one-third of the original figure, with the result that losses in the heaviest attack of all, on 4 March 1945, caused only 154 deaths.

499 e. Property Losses. Official figures are available concerning property losses. These figures are based on computations or relatively accurate estimates and give a fairly reliable picture of the destruction and damage done and the sequence of volume, in relation to overall property losses, for the individual States and cities or towns.

All in all the amount of rubble left in the wake of the war in the former territories of Germany within the pre-war borders is estimated at 400 000 000 cubic meters.

The following is a review of the quantities of rubble from destroyed buildings, etc., in some of the major cities.[663] in the present Federal Republic of Western Germany, including Berlin:

661. "Menschenverluste zweier Weltkriege," Professor Dr. H. Arntz, Bonn, in "Bulletin des Presse- und Informationsamtes der Bundesregierung," No. 64, 3 April 1953.
662. Appendix 42: "Erfahrungen aus den Luftangriffen des 2. Weltkrieges," by Lt. Col. Itzenplitz, Bundesamt fuer zivilen Luftschutz (Karlsruhe Document Collection.

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499 ~~Figures given in 1 000 cubic meters~~

Berlin	55 000	Frankfurt	11 700
Hamburg	35 000	Nuremburg	10 700
Cologne	24 100	Duesseldorf	10 000
Dortmund	16 777	Hanover	8 000
Essen	14 977	Bremen	7 920

Excluding Berlin, the following major cities headed the list if the rubble is computed per capita of the population:

Cologne	31.2 cubic meters	Essen	22.4 cubic meter
Dortmund	30.9 " "	Aachen	21.2 " "
Kassel	26.7 " "	Frankfurt	21.1 " "
Nuremburg	25.3 " "	Hamburg	20.9 " "

Out of 158 medium size towns the following had the largest amounts of rubble per capita of the population;

Giessen	34.4 cubic meters	Pforzheim	24.3 cubic meters
Dueren	33.1 " "	Kleve	23.2 " "
Datteln	32.7 " "	Zweibruecken	21.5 " "
Wuerzburg	31.3 " "	Hamm	20.3 " "
Darmstadt	26.00 " "		

A second method to compute the scope of destruction is bas d on statistics for residential quarters lost. Of the roughly 19 000 000 living quarters existing within the territories of Germany at the outbreak of war, roughly 4 000 000 were rendered uninhabitable by war damage. Of

663. Compiled from "Statistisches Jahrbuch deutscher Gemeinden."37th Year of Publication, 1949, under "Kriegsschaeden (pp. 361 ff.)"and "Staedtehygiene," Volume 2, February 1950, and quoted here from "Der hochrote Hahn", by Hans Rumpf, Verlag Mittler und Sohn,--Continued.

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500 this number (which includes 640 000 in the Soviet Zone of Eastern Germany) 2 750 000 living quarters were totally destroyed and the rest (21.3 percent) badly damaged.

The heaviest losses in living quarters in the present Federal Republich of Western Germany, including Berlin, were in the following cities:

Berlin	556 500	Duesseldorf	86 500
Hamburg	295 655	Duisburg	82 000
Cologne	176 500	Munich	82 000
Dortmund	105 500	Frankfurt	80 575
Essen	100 000	Hanover	75378

The best comparison results from a consideration of rubble quantities in their relation to the numbers of living quarters lost, although the retios here do not always coincide.

Town	Cubic meters of Rubble per Capita	Percentage of Living Quarters Destroyed
Berlin	12.7	37
Hamburg	20.9	53.5
Munich	6.5	33
Essen	22.4	50.5
Cologne	31.2	70
Dortmund	30.9	65.8
Frankfurt	21.1	45
Stuttgart	8.5	29.8
Duesseldorf	18.5	50.9
Bremen	17.6	51.6
Duisburg	12.9	64.8
Hanover	17.8	51.6

663--Continued: Darmstadt, 1952, pp. 145-6, which also contains a roster of all completely destroyed historical structures, (Nachweis der Voelling zerstoerten historischen Bauwerke), on pp. 147-150.

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Town	Cubic Meters of Rubble per Capita	Percentage of Living Quarters Destroyed
Wuppertal	18.9	39
Nuremburg	25.3	49
Gelsenkirchen	12.2	51
Bochum	12.1	51.9
Luebeck	4.5	19.6
Kiel	15.1	58.1
Mannheim	15.1	48.7
Braunschweig	11.5	51.9
Wiesbaden	3.1	22.9
Oberhausen	6.8	30.8
Karlsruhe	7.4	24.8
Augsburg	6.3	23.8
Krefeld	16.1	49.6
Bielefeld	12.8	26
Kassel	26.7	63.9
Muelheim	5.8	29.9
Solingen	10.3	20.1
Hagen	7.2	41.1
Aachen	21.2	47.9
Moenchen Gladbach	17.8	24.3
Regensburg	0.9	7.2
Ludwigshafen	14.5	55
Herne	0.7	14.6
Bonn	9.4	47.2
Bremerhaven	7.3	36.4
Muenster	17.7	39.3
Remscheid	19.7	50.6
Fuerth	2.6	10.6
Recklinghausen	1.3	21.9
Osnabrueck	17.1	54.6
Wilhelmshaven	12.7	60.2

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Town	Cubic Meters of Rubble per Capita	Percentage of Living Quarters Destroyed
Freiburg	9.4	34.2
Bottrop	3.7	39.6
Darmstadt	26	61.6
Offenbach	12.1	32.9
Wanne-Eickel	9	42.7
Goettingen	1.2	2.1
Mainz	13.3	54
Bamberg	3.3	4.4
Hildesheim	7.3	43.5
Trier	10.2	35.2
Ulm	12.8	44
Wuerzburg	31.3	74.1
Neuss	9.1	36.8
Bayreuth	8.6	35
Heilbronn	16	54.3
Hamm	20.3	60.3
Delmenhorst	10.4	61
Pforzheim	24.3	62.1
Worms	13.7	59
Giessen	34.4	76.5
Schweinfurth	14.6	33.5
Pirmasens	8.1	70.1
Bocholt	15.7	89
Paderborn	13.7	95.6
Dueren	33.1	99.2
Hanau	13	88.6
Ratingen	4.2	62.6

From Central Germany the following figures are available on the subject of living quarters destroyed:

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Town	Percentage	Town	Percentage
Bautzen	15	Halle	5
Brandenburg	20	Jena	15
Chemnitz	25	Leipzig	30
Cottbus	20	Magdeburg	50
Dessau	40	Merseburg	20
Dresden	60	Nordhausen	55
Eisenach	5	Plauen	50
Erfurth	5	Potsdam	20
Frankfurt on Oder	50	Rostock	25
Gera	10	Schwerin	3
Gotha	5	Zwickau	5

As these naked figures show, it was not the major cities which were most severely stricken, but a number of the 158 medium-sized towns. The compilation of destroyed living quarters gives no details on population movements, and therefore provides only inadequate data for any calculation of the actual population density in the individual towns.

To return to the example of Hamburg once again: Of the 560 000 living quarters in existence in Hamburg at the outbreak of the war more than 300 000 were rendered uninhabitable. Of this number 277 300 were totally destroyed and the rest badly damaged. 55 000 people lost their lives. The outcome of the Allied bombing attacks was that Hamburg lost in buildings as much as it was capable of constructing in

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502 roughly 45 average years, and all that was left was 43000000 cubic meters of rubble.

By October 1947 152 386 unexploded bombs had been removed, and approximately 700 were known to be still in existence at depths around thirteen feet within the city areas. By the same time 1 500 000 cubic meters of rubble had been cleared. In these activities Hamburg introduced entirely new methods and techniques. Rubble clearing and reconstruction operations went hand in hand. A rubble sorting machine, known as the Amund conveyor belt (Amundband) cleared and sorted 2 000 cubic meters of rubble per working shift, re-
503 claiming at the same time an average of 100 000 bricks which could still be used. By the spring of 1944 7 000 000 cubic meters of rubble were cleared and the central parts of the city were just about clear of rubble. All rubble which cannot be used for other purposes is removed by water transportation and used to good purpose in the construction of dams and river work.

In the beginning it appeared a hopeless undertaking to nedeavor to remove the gigantic quantities of rubble from even only the major cities within the foreseeable future. This alone was considered an exceedingly difficult task,

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not to mention the herculean task of rebuilding destroyed houses and refitting new living quarters.

Within the territories of the present Federal Republic of Western Germany alone bombs, artillery fire, and other acts of war had destroyed or so badly damaged more than 2 250 000 living quarters that they were no longer habitable.[664]

By the end of the war Western Germany lost 20 percent of its living quarters. Comparative figures for other countries are as follows: Netherlands 4 percent, Italy 4 percent, France 3 percent, Belgium 2 percent, and Great Britain 2 percent.[665]

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664. Karlsruhe Document Collection: "~~Informations dienst des~~ Bundespresseamtes," No. 6, 23 July 1953.

665. "~~Grunddaten des Wohnungsbaues in der Bundesrepublik Deutschland,~~" ~~Bundesminister fuer Wohnungsbau, Bonn~~, 15 August 1955.

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504 XI DEDUCTIONS FROM GERMAN PASSIVE AIR DEFENSE EXPERIENCE.

The following passages quoted from a lecture by Lieutenant General (~~General der Flieger~~) Doerstling at the Air University, Fort Maxwell, in June 1955[666] are offered as an opening for this final chapter of the present study:

> I shall confine myself to stating that in my opinion the concept was sound, that the ~~xxxxxx~~ aspects of the matter were considered and the necessary organization carried out in an exceptionally detailed and careful manner even before any practical experience was available. Essentially, the estimates and forecasts were correct and from the beginning of the war it was possibl to adapt them to current needs on the basis of daily experience. And what appears to me the most important point here is that even before the war an instrument had been created which, mobilized with sudden swiftness functioned immediately and, as previously stated, had only still to be adapted to the new circumstances without any necessity arising to make any basic changes in the solution adopted during peace.
>
> It is only natural that here also not all hopes materialized. As far as was humanly possible, however,

666. Karlsruhe Document Collection: "Home Defense (~~Heimat Verteidigung~~)," lecture by General der Flieger Egon Doerstling , at the Air University, Fort Maxwell, Montgomery, Alabama, pp. 47-48.

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504 everything necessary had been done in the fields of organization, training, and equipment to cope with air attacks and their possible results in relation to the war effort which at least insured that the purpose of such attacks, namely to paralyze the entire German war effort, was not fully achieved even after years, and to enable Germany, in spite of the enormous demands made on her resources on all fronts and within the Zone of Interior, to hold out for many years against an entire world of independent and rich powers, and to maintain all activities, such as industrial production, research, development, testing, transportation, the supply of food for the population, and the supply of all needs to the fighting fronts, in short all activities which go to make up the war effort, for so long.

In all air defense planning it was only possible, and in the future also will only be possible to conceive and apply successful measures if the facts, including those which are most unpleasant, are faced squarely. Any self-deception, any refusal to recognize what might be a terrible possibility but must be expected in respect to the capabilities and actions of an enemy can result in calamity and guilt.[667]

667. See II, a, above.

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505 The question of the share, in percentages, which the factors

a. The Soviet armies,

b. The blocade,

c. The Allied air forces

contributed towards the collapse of the Germany military forces General Doerstling answers: ".....at least 51 percent in favor of the air forces."[668]

The steadily increasing and systematically conducted disruption and destruction of the German potentials so paralyzed the forces in the field that, with the growingly acute shortage in replacements and supplies, continued resistance finally became impossible.

506 The experience gained in the individual fields of passive air defense have been dealt with previously in the appropriate chapters of this study, together with the lessons to be deduced therefrom.

Summarized experience reports were published currently throughout the war, not only by the Reich Minister for Aviation and Commander in Chief of the Air Force through Air Force Inspectorate 13 but, in agreement with this Office, also by the Board of industries for the Factory Air Defense System, and by the Reich Civil Air Defense Society for the Self Protection System. The Navy and the Army did the same.

668. See II, c, above.

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506 Although some of the stated requirements were translated into action already during the war, as was the case with the requirement for an increased number of mobile passive air defense units, for increased building construction, for the relocation of industries, and for evacuation of the civilian population, it was no longer possible under the impact of continuous attacks to bring about decisive improvements.

Under centralized direction by the present German Federal Institute for Civil Air Defense (Bundesanstalt fuer zivilen Luftschutz) the essential requirements for the future, with due allowance for the capabilities of modern weapons, have been analyzed.

A concise compilation of the analyzed experience deduced from the air attacks of World War II is offered in Appendix 43.[669]

A critical examination, in retrospect, of the organization, and above all of the command problems, of German passive air defense in World War II will also serve to convince the reader that passive air defense is an integrated part of the whole complex of home defense and not a purely civilian matter.

An important requirement evolving from the foregoing

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507 study is that the highest authority directing passive air defense should be placed directly under the Defense Ministry.[670] In line with the stated requirements and directives of this authority the organization and implementation of passive air defense measures would be a responsibility of the various Ministries in their respective fields. The command control in passive air defense activities, and in particular the tactical control over the mobile units, in contrast, will depend on the circumstances of overall home defense and is one of of the missions of the home defense system.

Also in the future passive air defense units dispatched on damage control missions will be targets of attack for enemy forces while on the march or in transportation to their area of operations. There can be no doubt that units striving to preserve the war potential, the very thing the enemy are striving to destroy, will be considered by the enemy as belligerents preventing the achievement of their purpose. It is indispensable that passive air defense units must be armed with weapons enabling them to defend themselves against air attacks and also against attacks by commando type units and/or partisans. It proved necessary also

670. Similar opinions are expressed in current publications, for example: "Atomwaffen und Luftschutz," by Colonel Ehrhard, and "Deutsch-franzoesischer Luftschutz an der Atlantikkueste," by Karl Kramp. Both articles in "Ziviler Luftschutz," Verlag Gasschutz und Luftschutz, Koblenz, Volume 3 and 5, 1956.

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507 in the past to so arm such units. Under these circumstances the question arises whether it is possible to equip mobile passive air defense units as purely civilian forces and place them under civilian control.

The above question requires very careful consideration for the future. Against the fact that other western powers have decided in favor of the civilian solution, is the fact that completely different conditions apply for the areas of Germany. Because of Germany's military-political location, these conditions approximate those which applied in the operational areas or zones[671] and in the occupied territories[672] in World War II.

In modern warfare the command must have available its own passive air defense troops, to be used as a supplementary force and employed both for its own military purposes and to protect the civilian population. In this field in particular cooperation between the European powers appears essentiial. With such an arrangement the joint or combined command will be able to take measures to insure that its operational measures will not be hampered or even completely prevented by the development of large damage areas or a panic of the civilian population. Also, the command will be able, with its own units, to prevent the destruction of its own militarily important targets. It is

671. See III, d, above. 672. See III, f, above.

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508 not possible to assign civil air defense in its present form this additional mission.

Only if the European nations act in accordance with a mutual passive air defense plan and support each other whenever necessary will mutual efforts to repel an attack meet with success.[673]

A firm and centralized direction of all passive air defense measures by a top level authority furnished certain powers even during peace is essential to insure, while working in close contact with the military authorities, that all general and specific passive air defense measures are uniform, which can be achieved only through clever coordination.

509 Continuous training activities and exercises by all organizations and specialized branches are necessary to insure that the entire apparatus is always existent and at all times ready for instant action, as is the case with a fire-fighting force. The existence of a defense and protective organization of this kind will give moral and practical support to the population, since the population will know that, within the milits of human capabilities, they are protected.

It is wise to avoid any changes in the peacetime organization during war.

All forces and all protective organizations at the

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509 local and at the regional level must be under a single commander with command machinery functioning smoothly already during peace. This is the only possible way to achieve maximum results economically.[674]

The following principles apply for the control and operations of passive air defense forces:[675]

Local passive air defense auxiliary services, even if under firm control and in protected premises, with command posts outside of the danger zones, will never be adequate to cope successfully with the damage caused in large scale attacks.

It is necessary to activate mobile units, meaning strong and technically well-equipped motorized units, and hold them in reserve outside of the danger zones in adequate numbers. Their significance as a supplementary support in large-scope damage control operations within cities, in industrial concerns, and in transportation establishments is indisputable, and undisputed. In published material units of this type are referred to

673. "Ueberstaatlicher Luftschutz," by Colonel Ehrhardt, in "Ziviler Luftschutz," Volumes 7-8, 1955, Verlag Gasschutz und Luftschutz, Koblenz.
674. Karlsruhe Document Collection: "Gedanken zum zweiten Weltkrieg," by Generalfeldmarschall Kesselring, 1955, p. 162. A 9-page excerpt will be found under the heading "Die Heimatverteidigung" in the Collection.
695. For more details see also "Grundsaetze fuer die Fuehrung im Luftschutz," Air Field Manual L.Dv. 751/1-2.

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510 in some cases as "Passive Air Defense Engineers (Luft-schutzpioniere).[676]

It is of eminent importance to have all command agencies highly mobile to prevent the irreparable consequences which would otherwise result from their loss, through enemy action, because of the highly complicated system of command control.

A proper direction of the operations of these mobile units presupposes the existence of a command organization, staffed by appropriately trained personnel, at the regional level, above the various passive air defense localities, and controlling areas approximately equal in extent to those under the former Commanders of Regular Police. At this level headquarters are necessary with small staffs familiar with the structure of their protective areas, and which already during peace are responsible for the activation and training of cadres for their mobile units.

It is clearly evident that when large numbers of mobile units converge on one point any lack of clearly defined mission assignments will result in serious confusion and at least seriously delay their action. For this reas-

676. See V, above. See also "Zur Geschichte des Luftschutzes," by Praesident Paetsch in "Grundfragen des zivilen Luftschutzes, Volume 1, 1953, Verlag Gasschutz und Luftschutz, Koblenz.

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510 reason authorities in this field have recommended that the command posts and other command centers of the passive air defense organization, particularly in endangered areas, should be assigned armored command cars providing protection against heat and radioactive radiation.[677]

Present and future requirements for passive air defense can only be determined on the basis of a thorough study of past advantages and disadvantages.

In World War II German expenditures for passive air defense as far as can be ascertained totalled only approximately 2 percent of the total expenditures for the conduct of the war Such small expenditures are entirely disproportionate to the vast expenditures made for the destruction of human life and of economic and cultural values.

The organization designed to protect the civilian population against air attack must at an early stage be provided the means it requires to develop and equip a defense and protective system capable of achieving its objectives.[678]

The following is a summary of the most important inferences drawn from practical experience in the various specialized branches of passive air defense:

(1) An air raid warning service must be adapted to

677. "Die Luftmanoever Carte Blanche," (24-28 1955) by Georg W. Feuchter in "Ziviler Luftschutz," Volume 9/1955, Verlag Gasschutz und Luftschutz, Koblenz.

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511 modern weapons and modern tactics of attack, and must be as flexible as possible in the matters of air situation reporting, alerting, and blackout requirements.[679]

The warning service in turn must make certain demands on the aircraft reporting services. The operating range of stationary radio stations on the ground is limited (approximately 150 miles maximum range). The question must therefore be examined whether it is not a positive "must" to use airborne radar stations to provide early enough orientation for the territories of Western Europe on current air situations. Modern radar instruments mounted on high-altitude aircraft undoubtedly can scan a much wider area than ground stations, even if these are mounted on highly elevated points of terrain.[680]

(2) All scientific and technological institutes, and all other research and testing stations, must cooperate closely in searching for ways and means through timely planning to prevent large-scale damage to civilian property, to the economy, and to the communications and transportation systems, or, if such damage is inflicted, to provide speedy and effective assistance.

678. "Heimatverteidigung und Luftschutz," by Colonel Ehrhard, in "Ziviler Luftschutz," Volume 4. 1955, Verlag Gasschutz uud Luftschutz, Koblenz.
679. See IV, a, particularly IV, a, 6, above.

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512 (3) All vital basic elements in towns, in the country, in industry, in the electricity supply systems, and in the communications and transportation services must be examined continually to discover weak points which render them sensitive to attack. Appropriate remedial measures must be planned and prepared.

(4) It is necessary to influence the population psychologically continually, in order to familiarize everyone both with the extent of the present-day dangers of air attack and with the possibilities for comprehensive precautionary measures of passive air defense. This is the only to instil and maintain a certain measure of confidence in the precautionary measures taken by the authorities. Even in the future the principle will still be valid that "Each individual must himself take the first steps to protect himself, namely through proper passive air defense discipline." "Self-protection" will retain its significance as the first line of resistance in the form of initial action against starting fires and in the form of first aid to injured and buried persons.[681]

(5) The problem of air raid shelters is closely bound up with what has just been said.[682] In its planning

680. See Footnote 677. 681. See IV, c, 1, above.
682. See VIII, and VIII, a, 5, above.

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513 the Ministry for Home Construction will have to differentiate between shelters classified for protection against near hits, subdivided into Class I and II, and against full hits, again subdivided into Class I and II.[683] Steps must be taken to investigate tunnels, underground installations and other possibilities of natural protection and if possible to prepare them for passive air defense purposes. Within cities and towns air shelters must be constructed already during peace; during peace they can be used for business purposses, for example, as garages, storehouses, movie theaters, etc.

6. Precautionary fire prevention is a matter of the utmost importance. It has been established that 80 percent of all damage caused by air attacks was due to fire.[684]

The tactics for action against large fires must be further improved and adapted to the requirements of the expected weapons of attack.

(7) In the fields of area planning or regional planning,[685] town development,[686] and the relocation of industries,[687] distributed multi-premises storage of valuable

683. "Baulicher Luftschutz," by Oberregierungsrat Leutz in "Grundfragen des zivilen Luftschutzes," Volume 1, 1953, pp. 98 ff., Verlag Gasschutz und Luftschutz, Koblenz.
684. See VIII, b, above. 685. See VIII,a,1,above.
696. See VIII,a,4,above. 687. See VIII,a,3, above.

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513 commodities, works of cultural value, and raw materials[688] the requirements of passive air defense must be effectuated with all emphasis alr ady during peace in a manner as described above in the appropriate sections of this study. Organizational preparations must be made in advance for the storage of all types of commodities in safe places if the need arise.

(8) A properly functioning transportation and communications service is of the utmost importance. Provisions for an adequate increase in personneland for the safe storage of repair materials are therefore required.

(9) Advance planning for proper personnel allocations is of vital importance for the effectiveness of all passive air defense units. In spite of the large military requirements for personnel, a situation must not be allowed under any circumstances in which only overage personnel remain available for passive air defense duties. The demands made on passive air defense personnel are exceedingly heavy in all operations. In addition, considerable training in technical subjects is necessary. It is therefore essential to insist on the assignment of fully fit personnel.

The selection of command personnal at all levels

688. See IV, k, above. 689. See IV, m, above.

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514 calls for very careful consideration.

(10) In the matter of items of equipment and resupply, the following requirements evolved:

Supply operations for the passive air defense localities and passive air defense units can only function smoothly if they have uniform and standardized items of equipment. At least some of the special type and other vehicles, including those of the firefighting services, must be capable of all-terrain travel in order to insure that crucial time will not be lost waiting for streets and roads to be cleared.

Supply points and supply channels will be prepared and, as far as possible, used already during peace as supply delivery depots.

(11) Careful preparations are necessary for the evacuation of those segments of the population who will not remain in cities during war, and this requires appropriate investigations.[689]

(12) A comprehensive organization must be established already during peace to take care of bomb-stricken populations. In materiel this means that relief trains of all types, food depots, clothing and household utensils depots, and transportation and billets will have to be

689. See IV, m, above.

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514 provided; in the personnel field it calls for the registration of numerous categories of specialists, male and female auxiliaries, etc., as far as possible on a voluntary basis. The Inter-Departmental Committee for Victims of Air Warfare (~~Interministerielle Luftkriegsschaeden Luftkriegsschadenausschuss~~)[690] could serve as a model here.

Proper care of the civilian population is just as important as the actual passive air defense measures. If the confidence of the population in the governmental measures of support is shaken, the will to resist will decline rapidly.

Within the scope of this welfare mission receiving areas for refugees from bombed areas must be established and investigated. Control of the huge refugee movements to be expected will create tasks of extraordinary difficulty for the executive authorities which, as is the case with the welfare mission, can only be mastered if all measures are systematically planned and if the control organization is properly integrated beforehand by means of field exercises.

(13) The necessity also evolves for precautionary measures against the possible use of chemical

690. See IV, L, above.

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515 weapons,[691] and for protection against diseases which could be caused by radiation.[692]

All measures of passive air defense must have a certain measure of flexibility. As long as the active air defense branch remains effective, passive air defense will play only a minor role. If the effectiveness of active defense declines however, the burden on the passive air defense system will increase steadily until it reaches the limits of capabilities. This means that the whole system stands or falls with the overall national defense effort.

If air superiority is lost, even the best passive air defense measures cannot change the course of fate. An effective system can, admittedly, alleviate the effects of air attacks and can accelerate recovery of the stricken industries, and relocation and decentralization measures can serve to postpone, but they cannot avert the end. Any passive air defense measures taken will always succumb to an enemy air force possessing air supremacy.

One accomplishment of decisive importance for the future can be achieved: Casualties among the civilian population can be reduced by means of an instilled proper air discipline

691. See IV, b, 3, above.
692. See "~~Ueber das Wesen der Strahlungskrankheit und ihre Bekaempfung~~," by Professor Dr. Langendorff, "in" Grundfragen des zivilen Luftschutzes," Volume 1, 1953, Verlag Gasschutz und Luftschutz, Koblenz.

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516 and proper passive air defense behavior on the part of every individual, and by means of properly planned public preparations in the fields of organization and welfare, and above all by means of a provision of adequate and effective air raid shelters and other technical structural measures.

In this sense a sound passive air defense system will be and will remain of decisive importance for the biological preservation of the Nation.

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ANNEX A

AIR FIELD MANUALS ON PASSIVE AIR DEFENSE SUBJECTS [693]

L. Dv. 95/11a: Gas Defense for all Arms--Means for Gas Detection (Gasabwehrdienst aller Waffen, "Die Gaserkennungsmittel) Identical with Army Field Manual H. Dv. 395/11.

L. Dv. 96 : Injuries Caused by Chemical Weapons (Kampfstoffverletzungen)

L. Dv. 401 : Air Raid Warning Service (Luftschutzwarndienst)

L. Dv. 410 : Passive Air Defense in Military Billets, Establishments, and Installations (Luftschutzdienst in Unterkuenften, Anstalten, und Anlagen der Wehrmacht)

L. Dv. 410/1 : Passive Air Defense in Garrisons, Troop Billets etc. (LS-Dienst in Standorten, Truppenunterkuenften, usw).

/2 : Passive Air Defense at Airfields (LS-Dienst auf Flughaefen)

/5 :(Luftschutzordnung) Passive Air Defense Regulations

/6 : Passive Air Defense Requirements in Construction of Military Installations (Excluding Hospitals) (Baulicher Luftschutz in Wehrmachtanlagen (ausser in Lazaretten))

/7 : Passive Air Defense in Construction of Military and other Hospitals, Sanatoriums, and Mental Homes (Baulicher Luftschutz in Lazaretten, Krankenhaeusern, Heil- und Pflegeanstalten)

693. List not complete.

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L. Dv. 410/8 : Firefighting Se vices (Feuerloeschdienst)

9 : Passive Air Defense Veterinary Service (LS-Veterinaerdienst)

10: Tables of Equipment (Ausrüestungsnachweisungen)

L. Dv. 751 : Principles of Passive Air Defense Command (Grundsaetze fuer die Fuehrung des Luftschutzes

Annex 1: Control in Passive Air Defense Locality (Fuehrung im Luftschutzort)

Annex 2: Command of a Motorized Passive Air De Defense Battalion of the Air Force (Fuehrung einer Luftschutzabteilung --mot.--der Luftwaffe)

3: Tactical Symbols in Passive Air Defense (Taktische Zeichen im Luftschutz)

L. Dv. 752 : Training Manual for Passive Air Defense Units (Ausbildungsvorschrift fuer Luftschutzeinheiten)

1a : Training in Firefighting Services, Vol. a: Vehicle and Equipment Familiarization (Ausbildungs im Feuerloeschdienst, Heft a: Fahrzeug- und Geraetekunde)

1b : Individual Training (Einzelausbildung)

3b :Training in Repair and Maintenance Service, Bol. b:Construction "Supporting and Stiffening," --January 1943 (Ausbildung im Instandsetzungsdienst, Heft b: Baukunde "Abstuetzen und Absteifen--Januar 1943)

3c : As above, Vol c: Blasting (as above, Heft c: Sprengen)

3d : Volume d: "Rubble Clearing and the Rescue of Buried Persons--January 1944 (Heft d: Beseitigung von Truemmern und Bergen Verschuetterter--Januar 1944)

L. Dv. 753 : The Safety and Auxiliary Services in Passive Air Defense (Der Sicherheits- und Hilfsdienst im Luftschutz)

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L. Dv. 753/4b: Directives for Water Supplies for Passive Air Defense Purposes: Long-Distance Sources (Richtlinien fuer die Wasserversorgung im Luftschutz: Loeschwasserversorgung ueber lange Wegstrecken)

Part 7: Das Defense (Teil 7: Der Gasabwehrdienst).

Volume c: Directives for Decontamination Parks (Richtlinien fuer Entgiftungsparks)

L. Dv. 755 : Directives for Establishment of the Extended Self-Protection System (Richtlinien fuer die Durchfuehrung des erweiterten Selbstschutzes)

/1 : Passive Air Defense in Prisons (Luftschutz in Gefangenenanstalten)

/2 Appendix 2: Passive Air Defense in Schools and Universities (Luftschutz in Schulen und Hochschulen)

L. Dv. 756 ::Factory Air Defense (Werkluftschutz)

15 Appendixes: Special Regulations for the Specific Types of Industrial Works (15 Anlagen: Sondervorschriften fuer die verschiedenen Betriebsarten)

Part VI: Factory Firefighting Service, Vol. 1: Directives for Activation of Firefighting Units 1938 (Teil VI: WerkFeuerschutz, Heft 1: Richtlinien fuer die Aufstellung der Feuerloeschkraefte, 1938)

Part III: Instructions for Factory Passive Air Defense Chiefs and Their Assistants--Observers (Teil III: Anweisungen fuer den Werkluftschutzfuehrer und seine Hilfskraefte--Beobachter)

L. Dv. 757 : Passive Air Defense in Ports, Waterways, and on Ships (Luftschutz in Haefen, auf Wasserstrassen und auf Schiffen)

L. Dv. 759 : Directives for Passive Air Defense under Responsibility of the Post and Telegraph Services (Richtlinien fuer die Durchfuehrung des Luftschutzes im Bereich der deutschen Reichspost)

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L. Dv. 760 : Passive Air Defense for the Reichsautobahn Superhighways System (Luftschutz der Reichsautobahnen)

L. Dv. 764 ::Removal of Enemy Dud Bombs. Annex 1:Instruction Sheets 1-10 (Beseitigung von Blindgaengern feindlicher Abwurfmunition. Beiheft 1: Belehrungsblaetter 1-10)

L. Dv. 770 : Regulations for Passive Air Defense Exercises Part 2: Directing and Umpire Services (Bestimmungen fuer Luftschutzuebungen Teil 1: Leitungs und Schiedsrichterdienst)

Part 1: Planning and execution of Passive Air Defense Exercises(1944) (Anlage und Durchfuehrung von Luftschutzuebungen--1944)

/IV: Damage Simulation in Passive Air Defense Exercises--July 1939 (Die Schadensdarstellung bei Luftschutzuebungen--Juli 1939)

L. Dv. 771 : The Biological Testing in Veterinary Research Stations of the Passive Air Defense Services of Foods and Animal Feeds Suspectedly Contaminated by Chemicals and after their Decontamination (Die biologische Pruefungvon Kampfstoffverdaechtigen oder entgifteten Lebens- und Futtermitteln in Veterinaer-Untersuchungsstellen des Sicherheits- und Hilfsdienstes)

L. Dv. 772 : Gas Defense

/1 : Procedures in the Field and Central Chemical Research Stations. (Die Arbeiten in der Kampfstoff und Hauptkampfstoffuntersuchungsstelle)

/2 : The Commodities Decontamination Station (Die Sachentgiftungsanstalt)

/3 : ABC of Commodity Decontamination (Sachentgiftungsfibel)

/4 : The Decontamination Park (Der Entgiftungspark)

L. Dv. 773 : Directives for Firefighting in Passive Air Defense (Richtlinien fuer die Brandbekaempfung im Luftschutz)

/1 : Appendix: Firefighting in Forests, Moors, and Heather (Anlage: Die Bekaempfung von Wald-Moor- und Heidebraenden).

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L. Dv. 779 : Storage and Adminstration of Fire Hoses (Lagern und Verwalten von Feuerloesch-Schlaeuchen)

L. Dv. 782 : Draft: Regulations for the Storage and Maintenance of Gas Defense Equipment of the Safety and Auxiliary Services (Entwurf: Vorschrift fuer das Lagern und die ~~XXXXXXXXX~~ Pflege des ~~Gasabwehrgeraetes des Sicherheits- und~~ Hilfsdienstes)

L. Dv. 783 : Equipment for Passive Air Defense Vehicles (~~Ausruestung von LS-Fahrzeugen~~)

/1 : Equipment Table and Loading Plan for ~~XXXXX XXXXX~~ Fire Truck--Type KS 25, 1936 (Ausruestungs- und ~~Beladeplan fuer Kraftfahrspritzen--~~KS 25 Bauart 1942)

/1a: As above for Type KS 25 Model 1942.

/1b : As above for Type LF 25 Model 1943

/2a : As above for Fire Truck with Trailer Carrying Portable Motor Pumps Type KZS Model 1937 (November 1940) (~~dto. fuer Loeschkraftwagen mit~~ Tragkraftspritzenanhaenger, KZS 8, Bauart 1937)

/2b : As above Model 1939

/3 : As above, for hoses, Type K W

/3a : As above, for hoses Type KW, Model 1941

/5 : As above, Decontamination Wagon with flat trailer (dto. fuer Entgiftungskraftwagen mit Troganhaenger) Type EGKW

/6 : As above, as Decontamination Equipment Wagon with Decontamination Equipment Trailer Model 1941 (dto. fuer Entgiftungsgeraetekraftwagem mit Entgiftungsgeraeteanhaenger Bauart 1941)

/7 : Table of Equipment and Loading Plan for Personnel Carrier (~~Ausruestungs- und Beladeplan fuer Mannschaftswagen des Instandsetzungsdienstes--IMKw-Bauart 1939~~) of Repair Services Model 1939

/7a : Draft for Model 1940--February 1941 (Entwurf: Bauart 1940--Februar 1941

/8 : As above for Model 1939

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L. Dv. 783/8a : As above for Model 1940

9 : Temporary Table of Equipment for Workshop Truck, Model 1940 (~~Vorlaeufiges Ausruestungsverzeichnis fuer Werkstattkraftfahrzeuge~~--WKfz. Bauart 1940)

10 : Table of Equipment for Light Type Supplementary Firefighting Boat --October 1940 (~~Ausruestungsverzeichnis fuer leichte Ergaenzungsfe~~ feuerloeschboote--Oktober 1940)

11 : Table of Equipment and Loading Plan for Ladder Truck, Type KL 26 Model 1939 (~~Ausruestungsverzeichnis und Beladeplan fuer Kraftfahr~~leiter--KL 26, Bauart 1939)

12 : Table of Equipment for a Repair and Maintenance Park, April 1941 (Ausruestungs~~verzeichnis~~ ~~nachweisung fuer einen Instandsetzungspark~~, April 1941)

13 : Draft: Table of Equipment and Loading Plan for Air Compressor Truck of the Repair Services Type 305/124 (~~Entwurf~~: ~~Ausruestungsverzeichnis und Beladeplan fuer Pressluftgeraetekraftwagen des Instandsetzungsdienstes--Pressl~~ Ger. Kfz. 305/124)

15 : Table of Equipment and Loading Plan for Fire Truck Type MS 8, Motor Vehicle 305/108, Model 1941, March 1942 (~~Ausruestungsverzeichnis und Beladeplan fuer Kraftfahrzeugspritze KS 8, Kfz. 305/108, Bauart 1941, Maerz 1941~~)

L. Dv. 787 : Instructions for Medical Supply Unit for Passive Air Defense First Aid Stations, with Packing Plan (~~Anweisung fuer den Satz Arzneimittel und Verbandmittel fuer LS-Rettungsstellen mit Packordnung~~)

L. Dv. 788 : Service Clothing Regulations for the Safety and Auxiliary Services, Category I, and the Air Raid Warning Service (~~Vorschrift ueber die Dienstbekleidung fuer den Sicherheits- und Hilfsdienst I. Ordnung und den Luftschutzwarndienst~~)

L. Dv. 789/1 : Smoke Generator Model Nb 80/2 (~~Das Nebelgeraet Nb 80/2~~)

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L. Dv. 792 : Construction Precautions at Passive Air Defense First Aid Stations (Bauliche Massnahmen bei LS-Rettungsstellen)

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ANNEX B

Annex B is a list of abbreviations with definitions for use with the German text. It is not being translated.

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ANNEX C

SOURCES

Source Number	Title	Author	Publisher
1.	Civil Air Defense (Der zivile Luftschutz)	Knipfer-Hampe	Stalling, Oldenburg
2.	Passive Air Defense in the World War (Der Luftschutz im Weltkrieg)	Hans Grimme	E.S.Mittler & Sohn, Berlin, 1941
3.	On History of Passive Air Defense (Zur Geschichte des Luftschutzes) in Heft 1 der "Schriftenreihe ueber zivilen Luftschutz	H. Paetzsch	Gasschutz und Luftschutz, Koblenz, 1953
4.	Fierce Fire (Der Hochrote Hahn)+	Hans Rumpf	E.S.Mittler & Sohn, Darmstadt, 1952
5.	Temporary Local Instructions for Civil Air Defense (Vorlaeufige Ortsanweisung fuer den Luftschutz der Zivilbevoelkerung)	Landrat des Kreises Siegen	Official Publication. 4th Edition, 1936
6.	Civil Air Defense Act, Text with Implementing Decrees (Das Luftschutzrecht--Textausgabe des Luftschutzgesetzes nebst Ausfuehrungsbestimmungen)	Darsow-Fokken-Borries	1943
7.	Civil Air Defense, in German Air Force Annual (Der zivile Luftschutz, in Jahrbuch der deutschen Luftwaffe)	~~Knipfer~~ Burkhard	~~Frankfurt~~ 1940

+ Fire is frequently called "Der rote Hahn (the Red Rooster)" in colloquial German as: "Er setzte ihm den Roten Hahn ins Dach (He set his roof on fire)."--Note by Translator.

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9.	Passive Air Defense and the National Socialist Party (Luftschutz und Partei, in Wehrmacht und Partei)	von Schroeder	Leipzig 1939
10.	Air Force Field Manuals	Aee Annex A	
11.	Special Annex 10 to Mobilization Plan (Air Force (Besondere Anlage 10 zum Mob. Plan (Luftwaffe	Reich Minister for Aviation and CINC of Air Force	
12.	The Last Month (Der letzte Monat)	Karl Koller	Norbert Wohlgemuth, Mannheim, June 1949
13.	Command in Passive Air Defense--Past and Present (Die Fuehrung im Luftschutz, in Ziviler Luftschutz, Heft 1, 1955)	Ehrhardt	Gasschutz und Luftschutz, Koblenz
14.	Air Warfare Experience in the Rhein-Westphalia Industrial Region (Luftkriegserfahrungen im Rheinisch-Westfaelischen Industriegebiet, in "Ziviler Luftschutz, Heft 3, 1956)	Schnitzler und Schmidle	Ibid
15.	Cologne in Air Warfare 1939-45 (Koeln im Luftkrieg 1939-45. Statische Mitteilungen der Stadt Koeln, 1954, Heft 2)		Statistisches Amt, Koeln

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17	The 1st Passive Air Defense Brigade (Die Luftschutzbrigade 1, in "Ziviler Luftschutz,Heft 1, 1956)	General-major Teschner	Ibid
18	US Strategic Bombing Survey--Civilian Defense Division, Final Report		
19	The Air Raid Warning Service (Der Luftschutzwarndienst) in "Grundfragen des zivilen Luftschutzes", Heft 1, 1955	Colonel Frey	Ibid
20	(Erfahrungen im Werk-Luftschutz-~~XXXXXXXXX~~ Gedanken zum Luftschutzwarndienst)Factory Air Defense Experience --Ideas on Air Raid Warning Service in Heft 4, 1955 of "Ziviler Luftschutz."		
21	Area Fires and Fire Storms (Flaechenbraende und Feuerstuerme)	Diplomingenieur H. Brunswig	Forschung und Technik im Brandschutz Volume 1, June 1952
22	(Feuer und Luftkrieg) Fire and Air Warfare, in "Brandschutz," Vol.3, 1956	Hans Rumpf	W. Kohlhammer, GmbH., Stuttgart

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23.	Fire and the Air War	Horatio Bond	Boston 60, Barrermarch Street 262
24	Chemical Warfare (Der Chemische Krieg) in "Schriftenreihe ueber zivilen Luftschutz, Heft 1, 1953	Dr. Mielenz	Gasschutz und Luftschutz, Koblenz
25	What do I do in an Emergency? (Was tue ich im Ernstfall?)+	CINC SS	Ministry of Interior, former German Government
26	Basic Passive Air Defense Instructions for Everyone (Der Luftschutzfaden fuer Alle)	Teetzmann, Reichs Luftschutzbund+	
27	ABC of Air Defense (Luftschutzfibel)	Luftschutzbund	Offen Worte, 1933
28	Passive Air Defense for the Hitler Youth (Luftschutz in der Hitlerjugend)	Reichsjugendfuehrung+	Former German Government
29	Heavy Air Attack (Grossluftangriff), in Heft 4, "Schriftenreihe des Luftschutzbundes."	Reichsluftschutzbund	Erwin Mueller, Berlin and Vienna, 1944
30	On Psychology of Passive Air Defense (Zur Psychologie des Luftschutzes) in Heft 6, 1953, "Ziviler Luftschutz."	Dr. Max Horst	Gasschutz und Luftschutz, Koblenz
31	Decree Concerning Civil Air Defense Society (Verordnung ueber den Reichsluftschutzbund), 14 May 1940		Reichsgesetzblatt I, p. 784

+ In Weltkriegsbuecherei, Stuttgart

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33	Mission Assignment of Civil Air Defense Society Presiding Council (Dienstanweisung fuer das Praesidium des Reichsluftschutzbundes), 28 June 1940		Ibid
34	Tactical Reserve for Factory Air Defense? (Eingreifreserven fuer den Werkluftschutz?) in Heft 3, 1955, "Ziviler Luftschutz"	Federal Board for German Industries	Gasschutz und Luftschutz, Koblenz
35	Industrial Passive Air Defense (Industrieller Luftschutz) Bulletins Nos. 1. 1 December 1931 2. 15 November 1943 3. 1933 4. 15 January 1934 5. 15 August 1935	Reich Board of Industries	Postwar reprint by Bundesverband der deutschen Industrie
36	WW II Experience in Factory Air Defense (Erfahrungen des Werk-Luftschutzes im 2. Weltkrieg) in Heft 1, 1953, "Schriftenreihe ueber Zivilen Luftschutz."	Dr. Wende	Gasschutz und Luftschutz, Koblenz
37	Factory Air Defense Orientation Bulletins (Schulungsbriefe des Werkluftschutzes)	Reich Board of Industries	Postwar reprint by Bundesverband der deutschen Industrie

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39	Protection against Fragmentation in Industry (Splitterschutz in der Industrie) in special issues Heft 10, I1, I2, 1942 "Baulicher Luftschutz."	Jacob Chormann	Copy in Karlsruhe Document Collection
40	Textbook on Passive Air Defense in the Army (Nachschlagebuch fuer den Luftschutz im Heer)	Wehrkreis III	Ludwig Simon, Berlin SW 11, 1942
41	Directives for Railway Passive Air Defense (Eisenbahnluftschutzrichtlinien--Eluri)	Reichsverkehrsministerium	Copy in Karlsruhe Document Collection
42	Shipyard and Port Air Defense (Werft- und Hafenluftschutz) in Heft 6-8, 1955, "Ziviler Luftschutz."	Karl Kramp	Gasschutz und Luftschutz, Koblenz
43	Experience on Use of Excavators as Heavy Equipment of Salvage Service (Erfahrungen im Einsatz von Baggern als schweres Geraet im Bergungsdienst) in Heft 7-8, 1954, "Ziviler Luftschutz."	H. J. Huetten	Ibid
44	Air Attacks against the Moehne-Eder-and Sorpe Dams, 16-17 May 1943, and Their Effects (Die Luftangriffe auf die Moehne-	Hans Rumpf	Ibid

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45	Directives to Prevent Destruction of Crops by enemy Air Attacks(Richtlinien ueber den Schutz der Ernte vor Vernichtung durch feindliche Luftangriffe) in "Runderlass des Reichsbauernfuehrers," 2 June 1943, II B 3/100/6		Copy in Karlsruhe Document Collection (MBLiV I p. 1098)
46	Official Publications on Passive Air Defense (Amtliche Verlautbarungen zum Luftschutz, Band 5/1944		Gasschutz und Luftschutz, Berlin Copy in Karlsruhe Document Collection
47	Directives for Measures Relative to Air Menace and Air Raid Damage (Richtlinien aus Gruenden der Luftgefaerdung und anlaesslich von Fliegerschaeden) in "Runderlass des Reichsministerium des Innern," 28 March 1941		Copy in Karlsruhe Document Collection
48	Evasion: The Natural Form of Protection (Ausweichen--der natuerliche Schutz) in Heft 2, 1956,"Gasschutz und Luftschutz." +		Gasschutz und Luftschutz Koblenz
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+ Report on flight of Hamburg population on the occasion of large-scale attacks in the summer of 1943.

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51	Passive Air Defense Structural Techniques (Bautechnischer Luftschutz) in "Handbuch der neuzeitlichen Wehrwissenschaften," Vol.III, Part 2, 1939		Copy in Karlsruhe Document Collection
52	Provisional Bulletin: Passive Air Defense Requirements in Town Developments (Vorlaeufiges Merkblatt: "Luftschutz im Statdtebau") Third Edition	Wohnungsbauministerium	Bauverlag, Wiesbaden-Berlin 1952
53	Global Mission	Field Marshal H. H. Arnold	Translation in Karlsruhe Document Collection
54	Passive Air Defense Construction Techniques (Baulicher Luftschutz) in Heft 1, "Schriftenreihe ueber zivilen Luftschutz,"1953	Oberregierungsrat Leutz	Gasschutz und Luftschutz, Koblenz
55	Building Construction--A Compilation of Text Reprints (Bauwelt--Wortlautsammlung)		Copy in Karlsruhe Document Collection
56	Directives for Air Shelter Construction (Richtlinien fuer Schutzraumbauten) in Sonderheft "Bundesbaublatt 1955."		Bauverlag GmbH Wiesbaden

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58	Shelter Tunnels and various Methods of Construction (Der Schutzstollen und die verschiedenen Arten seines Ausbaues) in Heft 10, 1955, "Ziviler Luftschutz."	Diplomingenieur (Bergbau) Fritz Ruhe	Gasschutz und Luftschutz, Koblenz
59	Air Shelter Regulations 1943-44 (Schutzraumbestimmungen 1943-44)	Reich Minister for Aviation & CINC, Air Force	Copy in Karlsruhe Document Collection
60	Regulations for Construction of Shelter Trenches (Bestimmungen fuer den Bau von LS-Deckungsgraeben) 1943	"	"
61	Organisation Todt Air Shelter Structures (OT-Luftschutzbauten: Deckungsgraeben): Shelter Trenches	"	"
62	Official Structural Specifications for Protection against Fragmentation (Bestimmungen fuer die bauliche Ausfuehrung von Splitterschutz) September 1942 Edition	"	"
63	Bombing Vindicated	Air Marshal I. M. Spaight	London 1944
64	Royal Air Force 1939-1945, Vol. III: The Battle is Won	Hilary St. George Saunders	Translation in Karlsruhe Document Collection

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66	Berlin under Bombing Warfare 1940-45 (~~Berlin im Bombenkrieg 1940-1945~~) in ~~Heft 2-3 "Ziviler Luftschutz~~, 1956	Hans Rumpf	Gasschutz und Luftschutz, Koblenz
67	Fire Fell from the Skies (~~Feuer fiel vom Himmel~~) in "Illustrierte Woche," Vol. 5, 1955	Karl Bartz	Excerpts in Karlsruhe Document Collection
68	The Outcome of Unrestricted Air Warfare against Germany (~~Die Bilanz des uneingeschränkten Luftkrieges gegen Deutschland 1942-1945~~) in "~~Flugwehr und Technik~~," Vol. 6-9, 1955.	Dr. Theo Weber	Photostat copy in Karlsruhe Document Collection
69	Civilians Killed by Air Warfare in Western Germany (~~Die Verluste der westdeutschen Zivilbevölkerung im Luftkrieg~~) in "~~Wehrwissenschaftliche Rundschau~~," Vol. 10, 1953	Hans Rumpf	"
70	Human Lives Lost in Two World Wars (~~Menschenverluste zweier Weltkriege~~) in Bulletin 64, 3 April 1953	Professor Dr. Arntz, Bonn	Presse- und Informationsamt der Bundesregierung
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74	Supra-National Passive Air Defense (Ueberstaatlicher Luftschutz) in Heft 7-8, 1955 "Ziviler Luftschutz."	"	"
75	Reflections on World War II (Gedanken zum zweiten Weltkrieg), 1955	Field Marshal Kesselring	Excerpts in Karlsruhe Document Collection
76	The "Carte Blanche" Air Maneuver (Die Luftmanoever "Carte Blanche") 24-28 June 1955, in Heft 9, 1955, "Ziviler Luftschutz."	Georg W. Feuchter	Gasschutz und Luftschutz, Koblenz
77	Home Defense and Passive Air Defense (Heimatverteidigung und Luftschutz) in Heft 4, 1955, "Ziviler Luftschutz."	Colonel Erhard	"
78	Radiation-Caused Diseases and Remedial Measures (Ueber das Wesen der Strahlungskrankheit und ihre Bekaempfung) in Heft 1, 1953 "Grundfragen des zivilen Luftschutzes."	Professor Dr. Langendorff	"

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