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

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."

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

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.

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 II,d, and VIII, a, 5, above.

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.

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-

419 required in the "Air Raid Shelter Regulations (Schutzraumbestimmungen)[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.

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.

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.

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/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 Document Exhibit~~ p. 6 of source quoted in Footnote 563

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.

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.

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,

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

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

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.

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.

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

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

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

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

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.

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.

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 describes 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]

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.

432 6. The protection of grainfields and of crops in general was a mission of the rural passive air defense sys-
572
tems.

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.

573
In a decree dated 11 February 1941 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

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.

438 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.

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.

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 himdrances during total blackouts and, together with another statute

580. Ibid, p. 126.
581. Karlsruhe Document Collection: "Kennzeichnung von Kraft- von Kraftfahrzeugen--Continued

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 duerfen," Rund-Erlass des RF. SS u. Chef der deutschen Polizei und des R. d. I. u. Ob. d. L. vom 5. 5. 1943 (MBl. i.V., p. 772).

582. See IV, e, 2, above.

437 of the Reich Board of Industries 582 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

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

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 583 could be exploited for plant operations. 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

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

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.

passive air defense.[584]

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."

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 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).

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.

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

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.

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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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

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.

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

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 Nebelgerat Nb 60/2."

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,

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), ~~xxxxxxxxxxxxxxxxxxxx~~ one of them equipped with ten of the previously mentioned captured Czechoslovak chemical trucks.

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 incorproated 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

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. Howevern one officer does

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

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.

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

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 outppt 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 cases where a smoke screen was not large enough it served to guide attacking enemy air forces to their target

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 bonb-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).

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.

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~~)" 595 by Major Worringen.

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.

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, traffic installations, and city areas.[597] 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).

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

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 natural orientation points in the terrain, it was essential to 460 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.

469 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

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.

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

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

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

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 perce
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.

465 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. ~~XXXXX~~ Appendix 37: "~~Uebersicht ueber Luftangriffe und Bom~~benangriffe im Monat April 1942.
604. Hans Rumpf: Der hochrote Hahn, Verlag E. S. Mittler und Sohn, Da mstadt, 1952, p. 56.

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.

465 No information is available on the results achieved.

466 The expenditures in 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.

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

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

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

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.

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.

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.

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.

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.

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.

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. As soon as appropriate methods for disposal had been developed, these were demonstrated at the Institute before representatives from the appropriate com-
612
mand authorities.

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
613
of current technical developments in the field.

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

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.

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.

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-

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615. For more details see Appendix 38.

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.

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.

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 it 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-

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

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 Luftkriegfuehrung," 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.

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,[626] Leipzig,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.

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.

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," typewritten copy from the journal "Wochenend."
632. Karlsruhe Document Collection: "~~Einsatz der Alliierten~~-- continued.

633

483 had become homeless through the air attacks.

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.

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."

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 ca 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 wasalready 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.

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 (Ruestungsstab) 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.

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.

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.

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.

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

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 meat 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

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.

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.

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.

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.

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 unimpaired 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).

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

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.

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.

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~~ 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.

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 663 from destroyed buildings, etc., in some of the major cities 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.

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 meters
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.

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.

500

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

501

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:

502

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

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,

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.

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.

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.

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 ~~pasi~~ sive 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.

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 669 43.

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

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.

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.

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

672.

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.

510 in some cases as "Passive Air Defense Engineers (Luftschutzpioniere)[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.

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.

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.

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.

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.

513 commodities, works of cultural value, and raw materials[688] the requirements of passive air defense must be effectuated with all emphasis already 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.

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.

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.

515 weapons, and for protection against diseases which could[691] 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.

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.

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.

L. Dv. 410/8 : Firefighting Se vices (Feuerloeschdienst)

9 : Passive Air Defense Veterinary Service (LS-Veterinaerdienst)

10: Tables of Equipment (Ausruestungsnachweisungen)

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)

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 Feuerloesch-kraefte, 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)

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).

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~~ Fire Truck ~~XXXXX~~--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 Instandsetzungsdien~~stes--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

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 Ergaenzungsfeuerloeschboote--Oktober 1940)

11 : Table of Equipment and Loading Plan for Ladder Truck, Type KL 26 Model 1939 (Ausruestungsverzeichnis und Beladeplan fuer Kraftfahrleiter--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--Press~~l 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 fr Medical Supply Unit for Passive Air Defense First Aid Stations, with Packing Plan (~~Anweisung fuer den Satz Arzneimittel und Verbandmittel fuer LS-Rettungs~~stellen 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~~)

L. Dv. 792 : Construction Precautions at Passive Air Defense First Aid Stations (Bauliche Massnahmen bei LS-Rettungsstellen)

ANNEX B

Annex B is a list of abbreviations with definitions for use with the German text. It is not being translated.

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)	Dersow-Fokken-Borries	1943
7.	Civil Air Defense, in German Air Force Annual (Der zivile Luftschutz, in Jahrbuch der deutschen Luftwaffe)	Burkhard	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.

Source	Title	Author	Publisher
8	Civil Air Defense, in Book of the German Air Force (Ziviler Luftschutz, in Das Buch der Luftwaffe)	Dr.Knipfer Dr.Eichelbaum	Prior to 1938
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

Source	Title	Author	Publisher
16	Franco- German Passive Air Defense on the Atlantic Coast (Deutsch-franzoesischer Luftschutz an der Atlantik Kueste, in "Ziviler Luftschutz, Heft 4-5,1956	Karl Kramp	Gasschutz und Luftschutz, Koeln
17	The 1st Passive Air Defense Brigade (Die Luftschutzbrigade 1, in "Ziviler Luftschutz,Heft 1, 1956)	Generalmajor 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

Source	Title	Author	Publisher
23.	Fire and the Air War	Horatio Bond	Boston 60, Barrer-march Street 262
24	Chemical Warfare (Der Chemische Krieg) in "Schriftenreihe ueber zivilen Luftschutz, Heft 1, 1933	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

Source	Title	Author	Publisher
32	Statutes of the Passive Air Defense Society (Satzung des Luftschutzbundes), 28 June 1940		Ibid
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

Source	Title	Author	Publisher
38	Structural Measures for Factory Air Defense (Bauliche Massnahmen im Rahmen des industriellen Luftschutzes) in Heft 12 1954, "Ziviler Luftschutz."	Dr.Ingenieur Friesecke	Gasschutz und Luftschutz, Koblenz
39	Protection against Fragmentation in Industry (Splitterschutz in der Industrie) in special issues Heft 10, 11, 12, 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

--Continuedon page 728

Source	Title	Author	Publisher
44--Continued:	Eder- und Sorpe-Talsperren 16-17 Mai 1943 und ihre Auswirkungen) in Heft 10, 1954"Ziviler Luftschutz."		
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
49	Passice Air Defense Command Control (Fuehrung im Luftschutz) in Heft 2, 1955, "Ziviler Luftschutz."	Generalleutnant Haenschke	Ibid

+ Report on flight of Hamburg population on the occasion of large-scale attacks in the summer of 1943.

Source	Title	Author	Publisher
50	Textbook for Instruction at AF Service Schools (Leitfaden fuer den Unterricht auf den Luftkriegsschulen) Chapter VII	Office of CINC Air Force	Copy in Karlsruhe Document Collection
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

Source	Title	Author	Publisher
57	The Air Raid Shelter (Der Schutzraum) in Heft 12, 1954, "Ziviler Luftschutz."	Dr. Ingenieur Wiendieck	Gasschutz und Luftschutz, Koblenz
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

Source	Title	Author	Publisher
65	The Road through Fire (~~Der Weg durch das Feuer~~) Cologne 1939-1945	Josef Fischer	~~M.DuXXXXXXXXXXXXXXXX~~ M.Dumont Schauberg, Cologne, Pressehaus. Copy in Karlsruhe Document Collection
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 uneingeschraenkten 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 Zivilbe-~~ westdeutschen ~~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
71	Information Service ofthe German Federal Press Office, Bulletin 6 of 23 July 1953 (~~Informationsdienst des Bundespresseamtes Nr. 6 vom 23. 7. 1953~~)		"

Source	Title	Author	Publisher
72	Basic Data on Home Construction in the German Federal Republic, 15 August 1953 (Grunddaten des Wohnungsbaues in der Bundesrepublik Deutschland vom 15.8.1953).		Bundesminister fuer Wohnungsbau, Bonn
73	Atom Weapons and Passive Air Defense (Atomwaffen und Luftschutz) in Heft 3, 1956 "Ziviler Luftschutz."	Colonel Erhard	Gasschutz und Luftschutz, Koblenz
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	"