Directorate of
Intelligence

Secret

25X1

Soviet Naval Repair Capabilities: Implications for Naval Readiness

25X1

A Research Paper

Secret

SOV 86-10021
April 1986

Copy 453

Directorate of
Intelligence

Secret

25X1

Soviet Naval Repair Capabilities: Implications for Naval Readiness

25X1

A Research Paper

This paper was prepared by
Office of Soviet Analysis. Comments and queries are welcome and may be directed to the Chief, Defense Industries Division, SOVA,

25X1

25X1

25X1

Secret
SOV 86-10021
April 1986

Sanitized Copy Approved for Release 2011/05/17 : CIA-RDP87T00787R000200210003-9

Soviet Naval Repair Capabilities: Implications for Naval Readiness 25X1

Summary

Information available as of 1 February 1986 was used in this report.

During the past 20 years the Soviets have carried out a massive naval construction program that has transformed their Navy from a coastal defense force into a modern "blue water" fleet. Their newer surface combatants are substantially larger than the older ones and have more striking power, and they have constructed more than 200 nuclear-powered submarines. 25X1

The growth of the fleet has led the USSR to greatly expand the size and capabilities of the naval yards responsible for its maintenance and repair. Shiplift capacity has increased as rapidly as the size of the fleet, and the repair facilities of the Northern and Pacific Fleets are now able to accommodate the largest Soviet naval units in operation or under construction. The floorspace of fabrication and instrument repair buildings—taken together—has expanded more rapidly than that of shore-based repair facilities as a whole. 25X1

This expansion has made it possible for the yards to better meet the sophisticated repair needs of advanced propulsion systems, weapon systems, precision instruments, and electronics; has increased repair efficiency; and probably has reduced dependence on Soviet civilian industry. To date, however, Soviet repair facilities remain capable of supporting only a short, hot war and—compared with Western standards—a low level of peacetime operations. This is consistent with the Soviet philosophy of naval readiness which continues to stress preventive maintenance, in-port readiness, and in-port/in-area training, rather than extended at-sea operations that would substantially increase repair requirements. The existing repair facilities probably would be overloaded by a prolonged shift to a high level of operations. 25X1

Most of the maintenance and repair of Soviet surface combatants and submarines takes place at 25 naval ship repair yards. Eight of these have been built since 1965, and all but two of those built before then have been expanded. Shiplift capacity—the total tonnage of ships that could simultaneously be removed from the water using all means available—has increased by 2.5 times, and floorspace in shore-based facilities has more than tripled. During the same period the tonnage of the fleet has nearly tripled. 25X1

25X1

The expansion of maintenance and repair capabilities has included:

- Five new repair yards for nuclear-powered submarines and three for surface ships.
- Five submarine repair halls, one of which may be usable for maintenance of the Typhoon-class nuclear-powered ballistic submarine.
- Twenty-seven floating drydocks (FDDs), including some built and purchased abroad, with a combined shiplift capacity of about 500,000 metric tons. Of those acquired abroad, the two largest—one from Sweden and one from Japan—have capacities of 80,000 tons each. These 27 FDDs have provided almost the entire increase in Soviet shiplift capacity during the 1966-85 period and the only means of lifting aircraft carriers in the Northern and Pacific Fleets.
- Facilities—at selected naval repair yards—capable of supporting the maintenance and repair of precision instruments and modern electronic equipment.
- Modern housing facilities for about 42,500 shipyard employees and family members.

25X1

We estimate that this 20-year construction program has cost the equivalent of at least $7 billion (1983 US $) with outlays peaking at more than $500 million per year in 1980 and 1981. During the period 1981-85, investment averaged about $375 million per year and was concentrated on the completion of projects begun in the late 1970s.

25X1

Construction starts declined sharply after 1980 but resumed in 1985; this resumption leads us to expect that major construction will continue into the early 1990s in at least three yards that service nuclear-powered submarines, probably at the level we witnessed in 1981-85. The nuclear-powered submarine fleet, which, since the early 1960s, has been the major factor driving the expansion of the submarine repair yards, has continued to grow. We believe future expansion and modernization will emphasize qualitative improvements that could further decrease reliance on Soviet civilian industry for repair services—eliminating the time-consuming shipment of equipment back to the production plants and, thus, decreasing the number of spares needed.

25X1

Contents

Sanitized Copy Approved for Release 2011/05/17 : CIA-RDP87T00787R000200210003-9

25X1

Soviet Naval Repair Capabilities: Implications for Naval Readiness

25X1

Background

The Soviet approach to naval readiness differs markedly from the approaches of Western navies. The Soviets stress readiness to deploy for combat on relatively short notice, rather than routine deployment of large forces. Although the number of Soviet naval ships at sea has increased in the past two decades, only a small part of the Soviet Navy is still regularly deployed away from home waters. Even Soviet naval units deployed abroad spend much of their time at anchor or in port.

To achieve a maximum force-generation capability in times of crisis, the Soviet Navy emphasizes in-port/in-area training, rather than extended at-sea operations. This emphasis sacrifices operational experience and crew proficiency to achieve high weapon system availability—a practice similar to that in Soviet fighter aircraft and armored forces. As a result of this readiness philosophy, the Soviets probably would have more than half of their submarines and major surface combatants available for combat within a few days and about 70 percent within two weeks.

The vast majority of repair and maintenance of Soviet naval vessels is carried out in 25 naval repair yards.[2] At these facilities, ships and boats are maintained in accordance with the requirements and regulations of the Planned Preventive Ship Repair System (PPSRS), which covers both civilian and naval vessels.[3] This system contains historic files of ship repair records,

[3] PPSRS is an element of the national Planned Preventive Repair System (PPRS), which covers the repair and maintenance of all machinery and equipment in the Soviet Union.

Repair Categories of the Planned Preventive Ship Repair System

Voyage Repair. *Normally carried out in home port by crew, aided by shore service and a shipyard. Auxiliary machinery and equipment, if they have been removed, are usually overhauled in the yard, and workmen are sometimes sent to the ship to perform repairs that require special skills and equipment.*

25X1

Small Overhaul. *Carried out to maintain the operation of ship systems at acceptable levels until the next shipyard repair. The frequency of such overhauls varies from one to four years and can take up to four months.*

25X1

Medium Overhaul. *Intended to bring a vessel's hull and operating systems up to a level equal, or almost equal, to those of a newly built ship. The frequency is every four to eight years, and the duration three to eight months.*

25X1

25X1

Drydocking/Shiplifting. *Ship is removed from the water to inspect and repair underwater portion of hull and ship systems. Conducted either separately or as part of a medium overhaul. Frequency depends on the area of operations and operating condition.*

25X1

Midlife Capital Overhaul. *Now used only on a limited basis and only after a thorough economic analysis because of its duration (a year or more) and high cost (up to 70 to 80 percent of a vessel's construction cost). When carried out, this category of repair often includes modernization and modification.*

25X1

which are used as a basis for establishing lifetime repair schedules for new ships and their equipment (see inset).

25X1

25X1

25X1

25X1

We have observed this system being applied to the maintenance of SSBNs and several classes of major surface combatants. Selected ships from the Kotlin, Kanin, and Kashin classes of major surface combatants were modified and modernized during midlife capital overhaul 10 to 15 years after they were delivered. The duration of Soviet naval ship repairs is longer than that reported for merchant ships; medium overhaul has averaged 24 to 30 months for Yankee-class SSBNs and 12 to 24 months for Delta-I-class SSBNs, while three to eight months is typically planned for merchant ships. The longer durations reflect the complexity of SSBNs—their nuclear-powered propulsion plants, weapons systems, and associated electronics.

25X1
25X1
25X1

The use of PPSRS scheduling and standards enables more efficient procurement of materials and equipment and better allocation of limited manpower.

However, it demands graving docks, shiplift basins, and floating drydocks (FDDs) sufficient to lift the tonnage of ships scheduled for repair or maintenance each year, with a margin for emergency or unplanned repairs. The system also requires repair halls, machine shops, and engineering and other buildings for fabrication of parts and repair and maintenance of the hulls, propulsion systems, armaments, electronics, and other technical systems of surface ships and submarines having both conventional and nuclear propulsion. How the Soviets have provided for the service base necessary to meet the demands imposed by their readiness philosophy and what it has cost them is the subject of this report.

Growing Repair Requirements

During the past 20 years, under the leadership of Admiral Gorshkov, the Soviet Navy developed from mainly a coastal defense force into a modern "blue water" navy operating the world's largest fleet of nuclear-powered submarines. In 1966 the main striking force of the Soviet Navy consisted of about 112 major surface combatants (at that time ships with displacements between 3,000 and 17,500 metric tons) and 34 nuclear-powered Hotel- , Echo- , and November-class submarines.[5] By 1985 the number of surface combatants—between 3,000- and 42,000-tons displacement—had increased to about 132 (an 18-percent increase), but the tonnage of these combatants had increased by nearly 60 percent. The nuclear-powered submarine fleet had grown to more than 200 ships by 1985, with a total tonnage of more than 1.2 million tons—450 thousand tons more than that of major surface combatants.

Repair requirements have been determined by the number and size of these ships, and even more by their increasingly sophisticated shipboard weapons and electronics, and advanced materials and propulsion systems. Some new classes demand repair yards capable of machining and welding titanium and aluminum, as well as steel, and capable of refueling and maintaining both pressurized water and liquid metal nuclear reactors. 25X1

The Expansion and Modernization Program

Our analysis of the 25 major Soviet naval repair yards indicates that the Soviets probably developed a long-range plan in the early 1960s to accommodate the increased repair and maintenance requirements of their rapidly growing naval forces. The expansion and modernization program was designed to:

- Increase the shiplift capacity at the repair yards to handle the increasing number and size of both surface combatants and nuclear-powered submarines.[6] 25X1
- Construct enough new shops and fabrication buildings to carry out the expected maintenance needs of a fleet that nearly tripled its tonnage in 20 years. 25X1
- Expand the capacity to refuel and maintain nuclear-powered submarines in the Northern and Pacific Fleets through expansion of existing yards and construction of new yards in those areas.
- Develop the capability to service precision equipment and electronics at repair yards near forward operating bases. 25X1

The expansion and modernization program began modestly in the last half of the 1960s, peaked during the period 1976-80, and has since declined. One part of the program concentrated on increasing the shiplift capacity at repair yards—the ability either to lift ships from the water and transfer them to land-based facilities or to work on them in FDDs. This phase was largely completed in 1981. The other part of the program concentrated on expanding shore facilities at existing yards and constructing eight new yards (see figure 1). This phase appears to be nearing completion, although a limited amount of construction is expected to continue into the early 1990s. We believe 25X1

[5] Minor surface combatants, patrol craft, amphibious craft, auxiliaries, and diesel-powered submarines, although numerous, have had relatively little effect on the growth of repair facilities that are described in this report, particularly because of the large reduction in the number of diesel submarines and because many of the smaller ships are serviced by minor yards not covered by our survey.

[6] Shiplift capacity, in thousands of tons, is a means of measuring the capacity of a ship repair yard to lift ships out of the water for maintenance. Total capacity (attainable only in theory) measures the tonnage that could be lifted simultaneously with every facility operating at a capacity load. 25X1

25X1

Table 1 (continued)

25X1

25X1

the capabilities of the repair yards have increased sufficiently to satisfy the peacetime operational requirements of the fleet.

Increase in Shiplift Capacity. Although a limited amount of emergency or diagnostic work can be done by divers, the capability for lifting ships of all sizes out of the water is an absolute necessity for ship maintenance and repair. Bottom cleaning and painting are needed periodically to remove and inhibit marine growth. Propellers, rudders, through-hull fittings, and the hull must be inspected regularly to ensure their proper operation; and damage from grounding, collision, or combat must be repaired to keep ships operational.

25X1
25X1
25X1

The Soviets lift ships in FDDs, graving docks, and shiplift basins (see figures 2, 3, and 4). FDDs can be built more rapidly and are much less costly to construct than graving docks or shiplift basins, and they can be easily delivered to repair yards in the most remote areas of the USSR. FDDs, however, are far more vulnerable to conventional attack than massive shore-based facilities, which cannot be sunk and are difficult to damage.

25X1

[7] See inset, "Sources of Information on Soviet Naval Repair Capabilities."

25X1

25X11

25X1

We estimate that in 1966 the USSR had shiplift capacity of 385,000 tons, of which about two-thirds was provided by 15 graving docks.

25X1

25X1

Until the late 1970s, the Kiev-class carrier could be lifted only at Sevastopol', which necessitated its return to the Black Sea for out-of-water maintenance. Nearly one-third of the shiplift capacity was provided by 16 FDDs with an estimated total capacity of 130,000 tons—the largest of which could accommodate only a Kynda-class cruiser of 5,700 tons.

The remaining shiplift capacity was provided by two shiplift basins completed in 1965

These basins had estimated shiplift capacities of about 11,000 tons and 9,000 tons, respectively. They are used mainly for lifting SSBNs out of the water to be repaired in adjacent repair halls.

The acquisition of additional FDDs provided almost the entire increase in shiplift capacity at naval repair yards after 1966 [8] (see figure 5). The number of FDDs acquired and their lift capacities were early indicators of Soviet plans for large-scale naval expansion. Through construction in their own yards and purchase abroad, the Soviets acquired 27 additional FDDs—the two largest could each lift 80,000 tons

25X1

Built in Japan and Sweden to Soviet specifications, they were delivered in 1978 and 1980. The acquisition

25X1

25X1

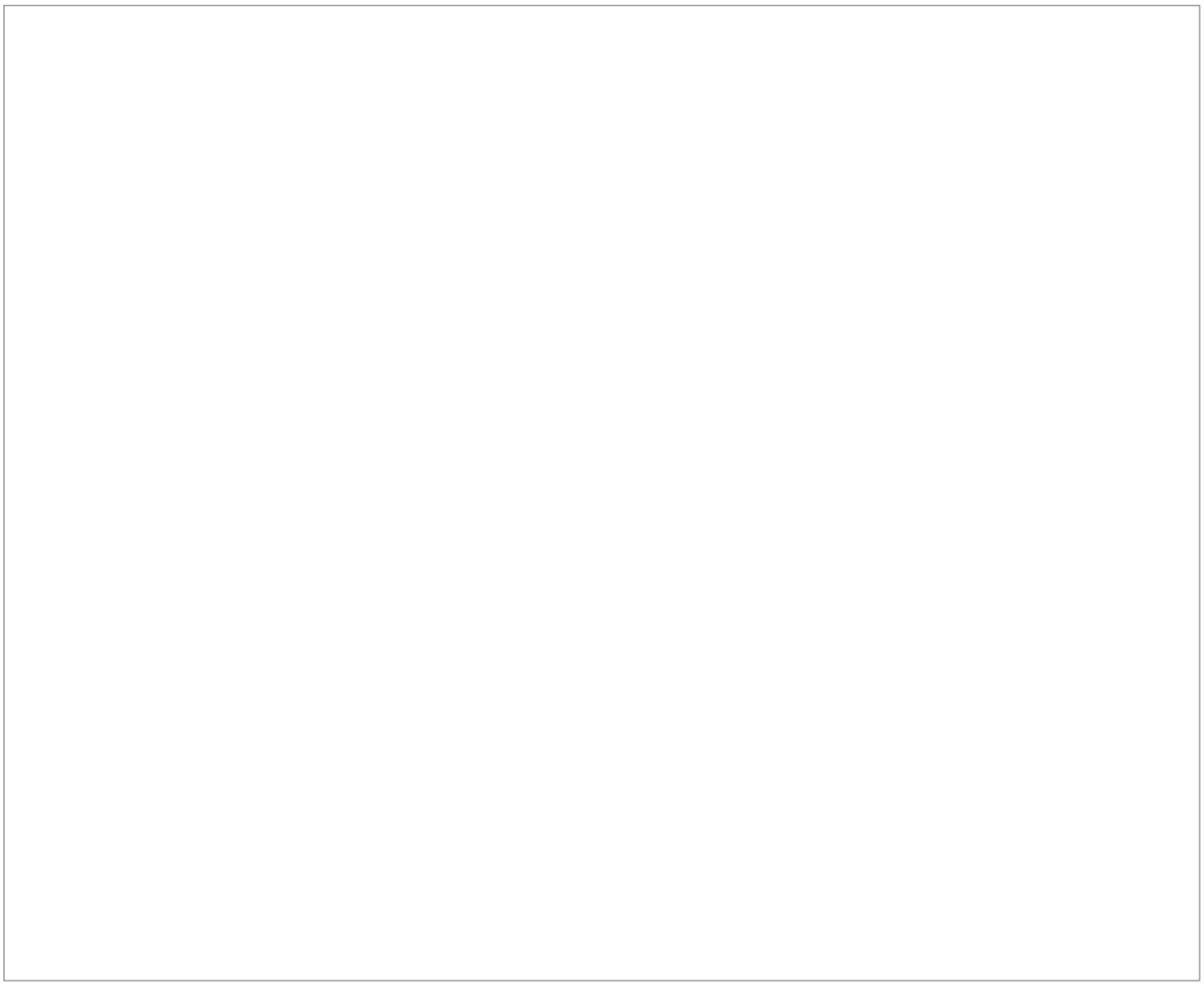
25X1

25X1

[8] One graving dock at Rosta Ship Repair Yard was lengthened by 75 meters, which increased its lift capacity by 10,000 tons. The capacity of a graving dock is determined by the displacement of the largest ship that can be lifted into the dock

25X1

25X1



25X1

25X1

of FDDs for naval repair yards ceased in 1981, indicating that the Soviets had approached their desired shiplift capacity—an estimated 900,000 tons.[9]

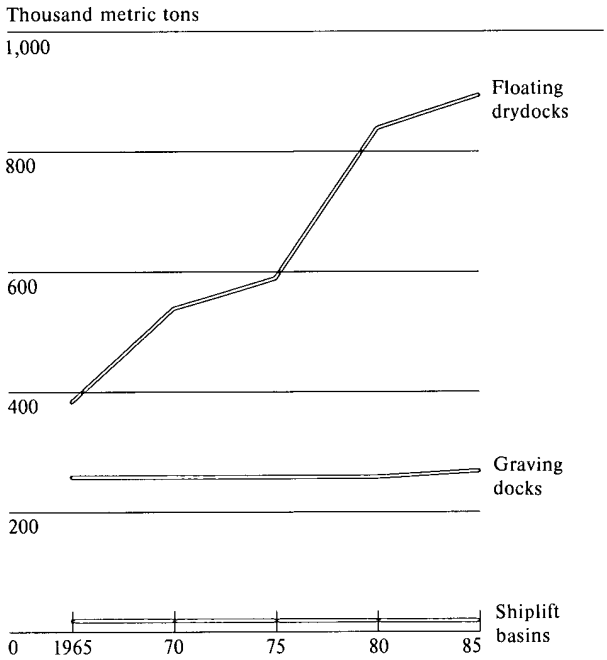
25X1

These 80,000-ton FDDs, among the world's largest, carry the latest Western repair equipment and can operate without support from shore-based facilities.

Each has an onboard electric generating plant, machine shops, cranes, and quarters for the repair personnel. These FDDs provide the only means in the Northern and Pacific Fleets of lifting the Kiev-class vertical-takeoff-and-landing (VTOL) carriers and the Kirov-class nuclear-powered cruisers. The shiplift capacity and size of these FDDs, however, were probably dictated by the size of the large, nuclear-powered

25X1

Figure 5
USSR: Estimated Shiplift Capacity at Naval Repair Yards, 1965-85[a]



[a] Lines are cumulative.

308740 4-86

aircraft carrier now under construction or possibly by plans for a larger carrier.[10] The docks are large enough to handle even the US Nimitz-class carriers in light condition (see figure 6)

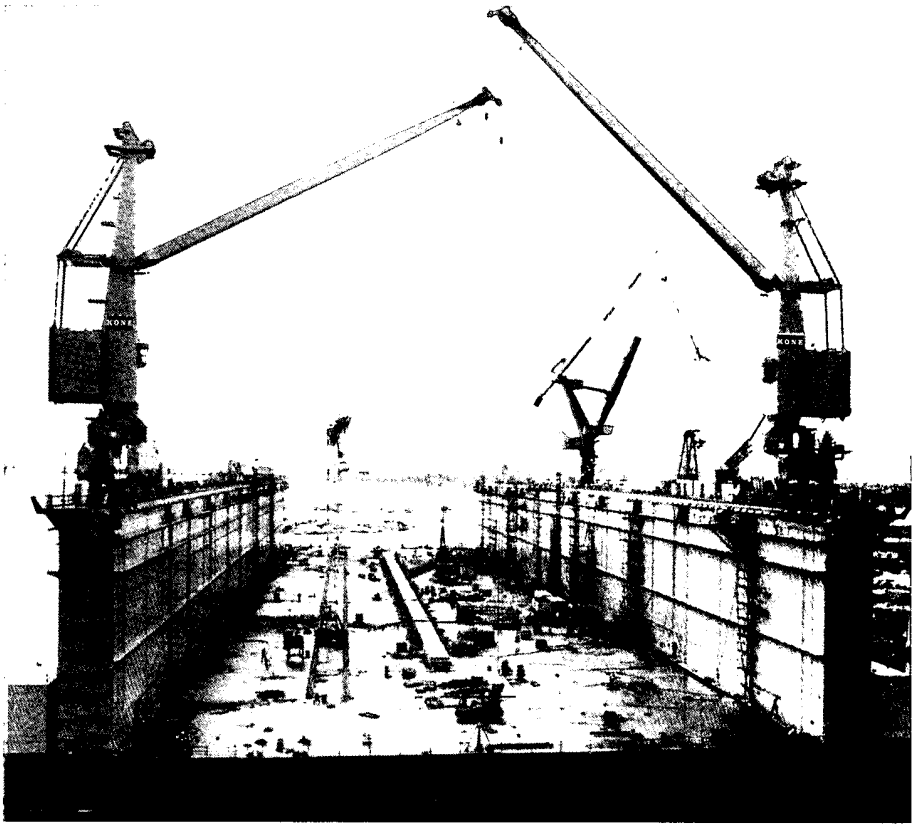
Construction of Shore Facilities. Concomitant with the increase in shiplift capacity, the USSR expanded and modernized shore facilities at naval repair yards. Over a 20-year period, facilities with about 900,000 square meters of floorspace were constructed. Shore facilities increased in area from 440,000 square meters in 1966 to more than 1.3 million square meters in 1985. The commissioning of repair yard facilities peaked during the first half of the 1980s with the completion of numerous buildings begun in the late 1970s. The low level of construction starts since 1980 indicates that the repair yards may be nearing their planned capacity. 25X1

Four types of buildings predominate at shore-based repair facilities: engineering/shop buildings, fabrication buildings, repair halls, and instrument repair buildings.[11] The distribution of growth in floorspace among these types of buildings reflects not only the growth of the Soviet fleet but also the introduction of modern repair methods (see figure 7). The continued, but diminishing, dominance of engineering and/or shop buildings indicates that growth of the fleet requires major expansion of traditional machining and metalworking capacity, while the emergence and growth of fabrication buildings reflect the introduction of subassembly, prefabrication, and modular construction. The construction of large repair halls and instrument repair buildings—at yards carrying out the medium overhaul of nuclear-powered submarines—reflects the growing complexity of these ships and the need for frequent repair of their instruments and electronic equipment. 25X1 25X1

Engineering/shop buildings accounted for 92 percent of total floorspace in 1966. By 1985, although their floorspace had doubled, they accounted for only 64 percent of total floorspace. These buildings house the basic repair processes: machining; repair of mechanical and electrical equipment; plumbing and wiring; and repair of major elements of propulsion plants, including steam turbines, gas turbines, diesel engines, and components of nuclear propulsion plants (see figure 8). 25X1 25X1

[11] There are also a number of old-style foundries, forges, and machine shops that total about 100,000 square meters of floorspace at old repair yards serving major surface combatants. These buildings were all built before 1966 but still appear to be in operation. 25X1 25X1

Figure 6. Swedish-built 80,000-ton floating drydock during construction.



The Motor Ship ©

25X1

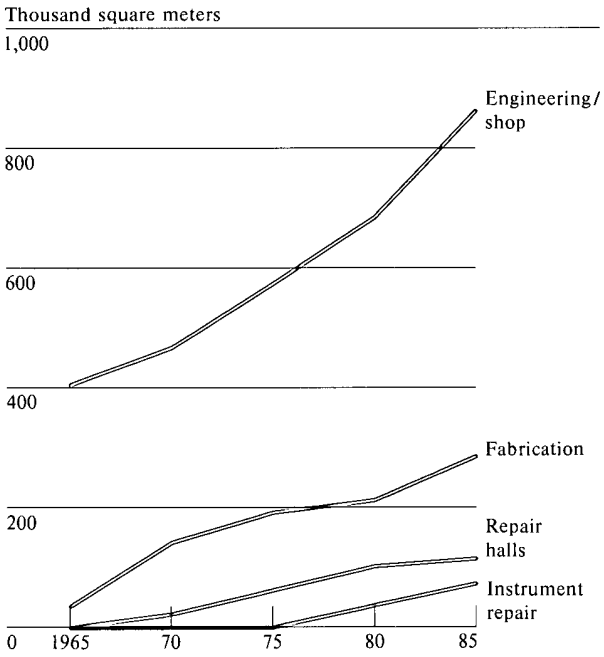
Fabrication buildings, now the second most numerous type, accounted for 8 percent of floorspace in 1966 and 21 percent by 1985. These buildings are located at repair yards that service major surface combatants and at the three yards that carry out medium overhaul of nuclear-powered submarines (see figure 9). They house metal-cutting, bending, welding, and related operations, including the preparation of subassemblies and modules. They permit the Soviets to carry out heavy metalworking operations—such as construction of bulkheads and deck or hull sections—in buildings with overhead handling equipment, proper lighting, and ample space, rather than in the cramped confines of a ship with hand tools, jacks, and chain hoists for handling materials. These buildings reflect the modernization of basic ship repair operations and reduce the time required for repair and maintenance and, consequently, enhance the operational availability of Soviet naval units.

Five large *repair halls* have been constructed since 1966—at a cost of $25-80 million each, depending on location (see figure 10).[12] They account for only 8 percent of total floorspace but are the largest buildings in the repair yards and have been built only at the three yards that carry out medium overhauls of nuclear-powered submarines. Four have been dedicated to the overhaul of Yankee- and Delta-class SSBNs since the mid-1970s. While not essential to the overhaul process, these halls make it more efficient by providing heavy bridge cranes for removal of hull sections and internal components; protection from the

25X1

25X1

Figure 7
Floorspace Completed at Naval Repair Yards, by Type of Building 1965-1985 [a]



[a] Lines are not cumulative.

308742 4-86

weather; lighting; and indoor storage of tools, machinery, and supplies. The allocation of resources for construction of these buildings clearly reveals the importance the Soviets place on the SSBN overhaul program. Most other nuclear-powered submarines have been overhauled outdoors.

We have identified what we believe are *instrument repair buildings* at two forward-area repair yards that service nuclear-powered submarines—at Pala Guba in the Northern Fleet and at Petropavlovsk in the Pacific Fleet. Their configuration suggests that they are a modification of a Soviet single-floor production building for precision-instrument production in which the production areas have been reduced, but the hermetically sealed assembly area and the testing and storage areas have been kept intact (see figure 11).[13] If true, this shift of precision-equipment repairs to yards in the forward area represents a distinct change in maintenance procedure. Up to now, the Soviets have generally removed equipment needing maintenance from a ship, replaced it from stock, and returned it to the production plant for repair. The new practice should shorten and simplify the logistic pipeline and, thus, should reduce the number of spares needed. It possibly has been adopted because of the increasing cost of electronic equipment and instruments, a shortage of such equipment, the need for increasingly frequent repair, or a combination of all three.

25X1

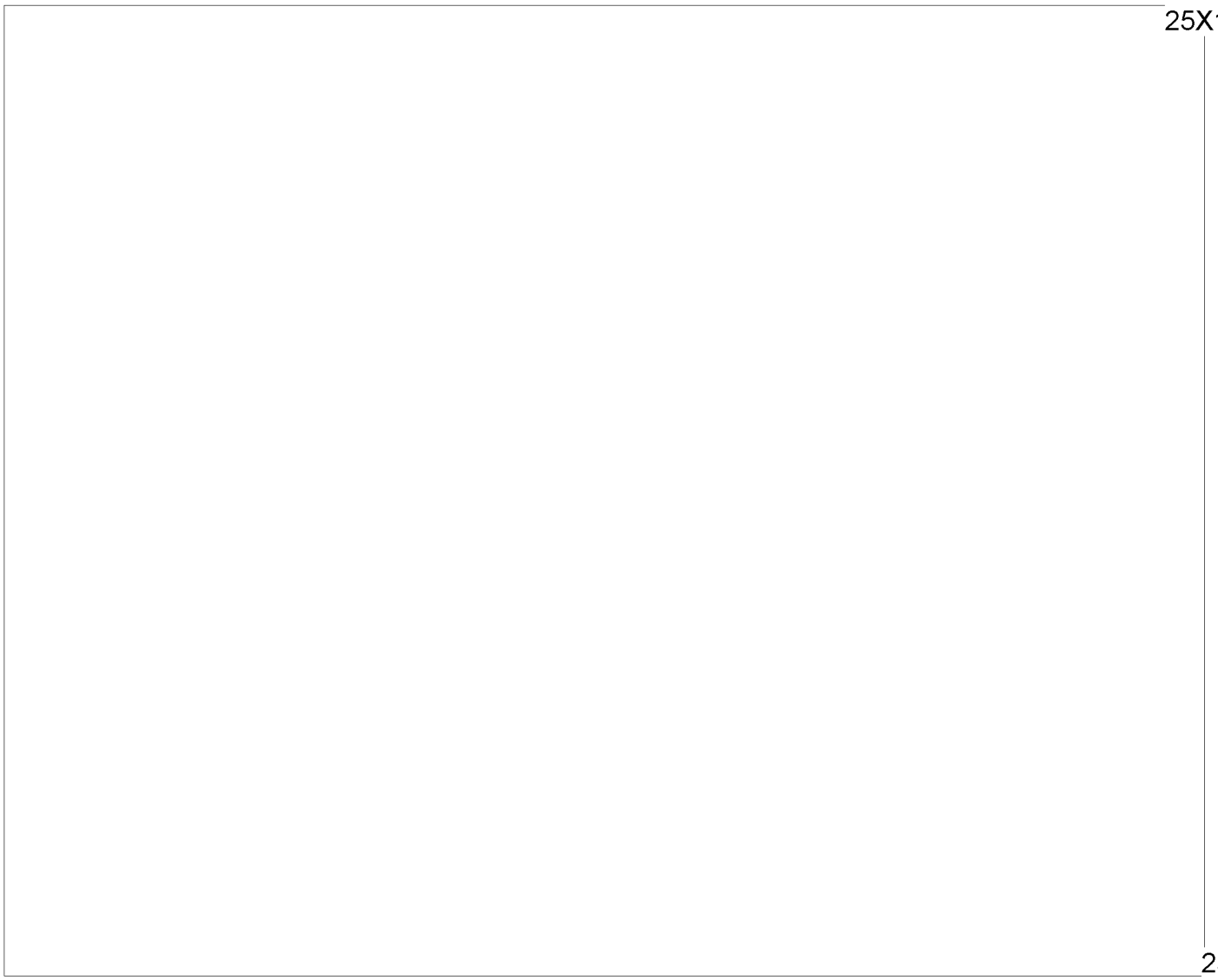
Cost of the Program

We estimate that, from 1966 through 1985, the USSR invested the equivalent of at least $6.8 billion [14] in the construction and expansion of naval repair yards. A minimum of $3.5 billion was invested in the yards themselves—including $3.1 billion for the construction and equipping of shore facilities and about $400 million for the construction and acquisition from abroad of FDDs. An additional $3.3 billion was invested in the construction of housing for repair yard workers and their families. The program began modestly in the late 1960s, peaked during the period 1976-80, and appeared to be slowing during the period 1981-85. The program reached a high point of over a half billion dollars a year in 1980 and 1981 (see table 3).

25X1
25X1
25X1

[14] Costs are expressed in 1983 dollars and represent what it would cost to construct these facilities in the United States to Soviet specifications. The estimates of construction at the yards were based on a detailed cost estimate of each repair yard and were arrayed by fleet. Likewise, the costs of housing areas were based on a detailed study of the housing areas that could be clearly related to an adjacent repair yard. We believe the estimates are accurate to within ±10 percent.

25X1
25X1
25X1



25X1

25X1

Evaluation and Outlook

The Soviets concentrated their expansion and modernization efforts on nine repair yards in the Northern and Pacific Fleets. Seven of these yards serve nuclear-powered submarines, and two are designed to serve the largest surface combatants.

We believe the capabilities of the repair yards have increased to satisfy the peacetime operational requirements of the fleet. overall growth in naval ship repair facilities has kept up with the fleet's growth and the increasing complexity of its units. The number of major surface combatants and nuclear-powered submarines increased from about 146 units in 1966 to about 330 units by 1985, while their tonnage nearly tripled. During the same period the floorspace in the repair yards more than tripled and the lift capacity increased nearly two and a half times. Further, the buildings in the yards and the new FDDs acquired to lift ships were sized to accomodate the large size and tonnage of both nuclear-powered submarines and surface combatants entering the fleet.

25X1

25X1;X1
25X1

25X1

Next 1 Page(s) In Document Denied

25X1

Table 3
USSR: Distribution of Capital Investment in Naval Repair Yards and Associated Housing Areas, 1966-85

Million 1983 US $

Area	1966-70	1971-75	1976-80	1981-85	Total
Total	**1,045**	**1,505**	**2,423**	**1,870**	**6,843**
Repair yards	531	720	1,488	790	3,529
Northern Fleet	190	429	983	477	2,079
Pacific Fleet	262	255	357	235	1,109
Baltic Fleet	27	23	99	64	213
Black Sea Fleet	52	13	49	14	128
Associated housing areas	514	785	935	1,080	3,314

25X1

The Soviets have made qualitative improvements in their repair capabilities commensurate with the increasing complexity and technological sophistication of their modern naval platforms, weapons, and support systems. These new and modernized yards are better equipped than the older yards to perform the full range of repair and maintenance functions. In these yards, the engineering buildings, shops, and fabrication buildings are large, layouts provide easy access to the buildings, and—where appropriate—transversers have been constructed to move ships or ship sections in and out of repair halls. All of these improvements expedite the repair process. The clearest indication of qualitative improvement is the recent completion of instrument repair buildings at forward area repair yards in the Pacific and Northern Fleets. These buildings will allow the Soviets to repair precision instruments and electronics in the forward areas, reducing the need to transport them thousands of miles back to the production plants for repair.

The increasing tempo of work we have observed at the most advanced of these yards, those which overhaul SSBNs, indicates that expansion and qualitative improvement of the yards and their equipment is paying off in more efficient repair operations.

A reduction in repair time has also been observed in the Pacific Fleet, although it occurred about five years later and has not yet equaled the best turnaround time in the Northern Fleet. Moreover, the naval repair yards are probably becoming less dependent on Soviet civilian industry, as increasingly more complex repair work is being carried out in them. These changes in naval ship repair are consistent with changes we have observed in the repair and maintenance of tanks and aircraft; they probably reflect the Soviet intention to make military theaters less dependent on extended supply lines to civilian industry.

25X1

Nonetheless, the repair facilities, despite continuous expansion, remain capable of supporting only a relatively low level of peacetime operations, by Western standards. The repair yards of the Northern and Pacific Fleets, which directly support open-ocean operations of both major surface combatants and nuclear-powered submarines, are heavily used; other repair yards in the Baltic and Black Sea Fleets are poorly located to assist them. The Soviets have built facilities capable of keeping a large share of the navy in a high state of in-port readiness. However, they have not given themselves the option of being able to shift to a prolonged high level of operations without rapidly overloading repair capabilities and encountering a serious decline in the operational capabilities of their fleet.

25X1

25X1

25X1

In addition, the use of FDDs as the major means of lifting ships for repair and maintenance has a negative side. Although they are flexible in the way they can be used and easily relocated, they can only be moved slowly and are vulnerable to air attack with conventional weapons.

Further, we believe the program to improve repair capabilities will continue on its present course. There probably will be an increased emphasis on responding to qualitative improvements in the Navy, but the Soviets are unlikely to try to improve their repair base to support greatly expanded peacetime operations. The steady growth of the fleet suggests that construction starts will rise in the period 1986-90. The tonnage of ships in the fleet increased during the period 1981-85 by about the same amount as in the previous five years, although fewer ships were built.

Ongoing construction activity and the need to overhaul newly introduced classes of nuclear-powered submarines suggest that additional construction will be undertaken at yards servicing nuclear-powered submarines.

- At Dunay, about 45 kilometers east of Vladivostok, dredging, probably for a graving dock or shiplift basin, has been under way since 1977. We believe that additional onshore construction will be carried out to develop Dunay into a major yard.

- At Olen'ya Guba—the only forward-area yard that carries out medium overhauls of nuclear-powered submarines—a limited amount of construction was under way in 1985, and space is available for more. Moreover, the amount of housing available there is far more than at other yards with comparable facilities and there is a 300-bed hospital, perhaps indicating that additional repair facilities are planned. 25X1

25X1

25X1

We correlated the timing of construction and, thus, investment in the repair yards with increasing repair demands as reflected in growth in tonnage of major combatants and nuclear-powered submarines. For example, a surge in ship deliveries in one five-year plan was followed by a surge in investment in the following plan (see figure 12).[15] This relationship is plausible in view of the requirements in the PPSRS for the first medium overhaul to occur four to eight years after initial operations.[16] On the basis of the relationship between tonnage increase and investment that prevailed for at least 15 years, we estimate that investment in repair yards during the period 1986-90 should remain at about the 1981-85 level—about $800 million—despite the relatively few construction starts we noted in the past several years. 25X1

25X1

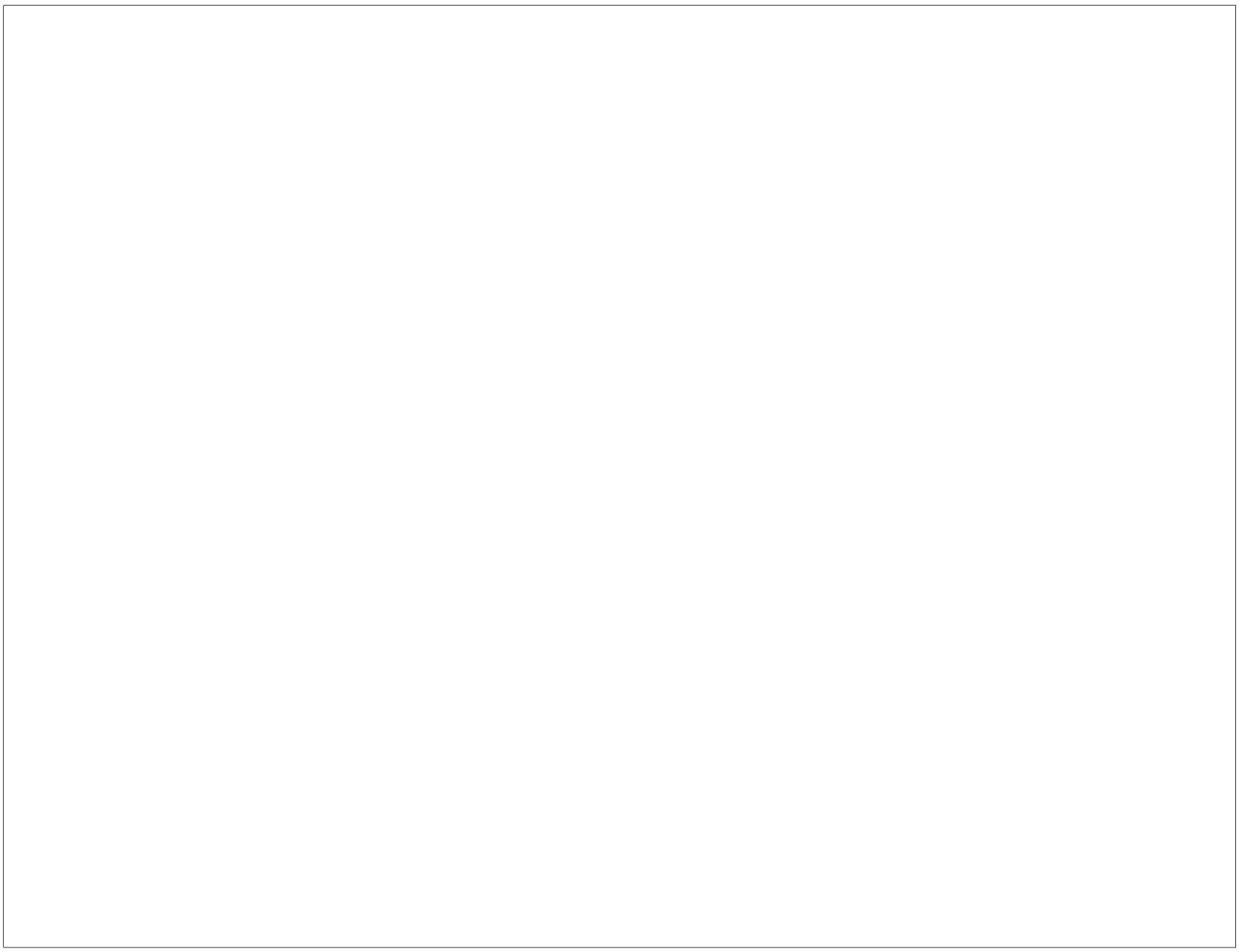
25X1

Two-thirds of this increase in Soviet naval tonnage during the period 1981-85 was accounted for by growth of the nuclear-powered submarine fleet. On

[15] The increase in tonnage of the fleet is the total tonnage of new major surface combatants and nuclear-powered submarines delivered in each five-year-plan period less the tonnage of vessels scrapped, lost at sea, or exported. 25X1

25X1

25X1



25X1

the basis of the relationship between fleet tonnage and investment, we estimate the nuclear-powered submarine repair yards will account for at least two-thirds of the total.

We do not expect much further expansion of yards serving the surface fleet and the diminishing fleet of diesel submarines. Extensive repair facilities for diesel submarines and all but the largest major surface combatants and carriers were present in all four fleet areas in 1966 and have been expanded during this construction program. The largest ships in commission, as well as the aircraft carrier under construction, can now be maintained in both the Northern and Pacific Fleets. We see little need for much further expansion under present Soviet operational practices.

25X1

25X1

Appendix

Construction Cost Estimates for Soviet Repair Yards

Construction cost estimates are based on unit costs of construction derived from the 1970 series of Soviet handbooks used by the Soviets in revaluing the USSR's fixed capital assets.[17] We used Soviet data for each type of building: structure, basic dimensions, location, and climate.

Finally, we estimated ruble costs and converted them to dollars using a ruble-dollar ratio of 0.267 1970 rubles per 1983 dollar.[19] Construction cost estimates based on this method have been checked by estimating the cost of US military facilities and comparing the results with the actual US costs. Estimates have been found accurate to ±10 percent.

Total capital investment was determined by the construction-as-a-percent-of-total method. For new projects or major expansion, construction's share in total capital investment for the appropriate sectors of the machine-building and metalworking industries was about 55 percent in the late 1960s, decreasing to about 45 percent in the late 1970s, according to Soviet texts on the economics of industrial construction. The machinery and equipment share of investment may be understated in later years because of the increasingly complex and costly machinery reported to be installed in Soviet shipyards but not reflected in the texts available. Thus, we estimate the accuracy of capital investment to be about +10/−15 percent.

Table 4 *Million 1983 US $*
Estimated Capital Investment in Repair Yards of the Northern Fleet, 1966-85

Total	**2,079**
Litsa Guba South and Southwest [a]	45
Olen'ya Guba [a]	639
Pala Guba [a]	381
Chalmpushka	3
Rosslyakovo	79
Rosta/Sevmorput	619
Gremikha [a]	
Yagri Island, Severodvinsk [a]	313 [b]

[a] Yards serving mainly nuclear-powered submarines.
[b] If located in the arctic zone as are the other Northern Fleet yards, Yagri Island would have cost $663 million.

Northern Fleet

Investment in the Northern Fleet repair yards began modestly during the period 1966-70, more than doubled during the next five years, and doubled again, reaching nearly $200 million per year in the period 1976-80. From 1981 through 1985, investment tapered off to about half of the previous level (see table 4).

Investment in the Northern Fleet was dominated by the large-scale expansion of three yards that service nuclear-powered submarines. Costs were very high because all yards at the Northern Fleet—except Yagri Island, Severodvinsk—are in the Arctic zone where costs are three and a half times those in the Moscow area. Within the Northern Fleet, repair yards that service nuclear-powered submarines have accounted for two-thirds of the capital investment.

Table 6 *Million 1983 US $*
Estimated Capital Investment in Repair Yards of the Baltic and Black Sea Fleets, 1966-85

	Investment
Total	**341**
Baltic Fleet	213
Baltiysk	81
Leipaja	28
Tallinn/Kopli	68
Tallinn/Morskoy Zavod	7
Kronshtadt	29
Black Sea Fleet	128
Sevastopol'/Kilenbalochnaya	50
Sevastopol'/Panaitova Bay	78
Sevastopol'/Sevmorzavod	

Capital investment in yards that service the surface fleet was used mainly for expansion of the Rosta Naval Base and Ship Repair Yard, Sevmorput, and for purchase of the 80,000-ton FDD that is moored at nearby Roslyakovo Shipyard. Rosta is the main repair yard for major surface combatants in the Northern Fleet and has been modernized and expanded significantly. Roslyakovo, only a few kilometers away, is a small yard whose major asset is the 80,000-ton FDD that is used for minor repairs and shiplifting of many types of naval vessels and in support of operations at Rosta.

Pacific Fleet

Investment in the Pacific Fleet repair yards was distributed over time more evenly than investment in Northern Fleet yards. There was only a small surge in the period 1976-80. Total investment in the Pacific Fleet area was about half that of the Northern Fleet—mainly because of the much lower construction costs in the latter area. The physical volume of the construction was nearly comparable.

Yards serving the nuclear-powered submarine fleet received nearly 60 percent of the investment in Pacific Fleet repair yards. The major repair yard at Petrovka—the only yard in the Pacific Fleet to carry out medium overhaul of nuclear-powered submarines—was expanded, and two new yards were built—one at Dunay near Vladivostok and the other on Kamchatka Peninsula near Petropavlovsk.

Yards serving surface ships and diesel-powered submarines also were expanded substantially. Vladivostok Shipyard Dalzavod and Sovetskaya Gavan' Shipyard 263, which had extensive facilities in 1966, were expanded and modernized. Either of these yards can lift and repair all classes of surface combatants except for Kirov-class (CGN) and larger ships. In addition, a major repair yard has been under construction at Slavyanka since 1968. It has alongside mooring for the largest ships, including the nuclear-powered aircraft carrier now under construction. Shiplifting, however, would have to be done in the 80,000-ton FDD at nearby Dunay Shipyard (see table 5).

25X1

25X1

25X1

Baltic and Black Sea Fleets

Investment since 1965 in repair yards of the Baltic and Black Sea Fleets amounted to only about $340 million, all in yards serving the surface fleet and diesel-powered submarines. Most of the yards were well developed by 1966. They are not located in areas suited to support the open-ocean surface navy or the nuclear-powered submarine fleet; moreover, there are no repair yards for nuclear-powered submarines in either fleet (see table 6).

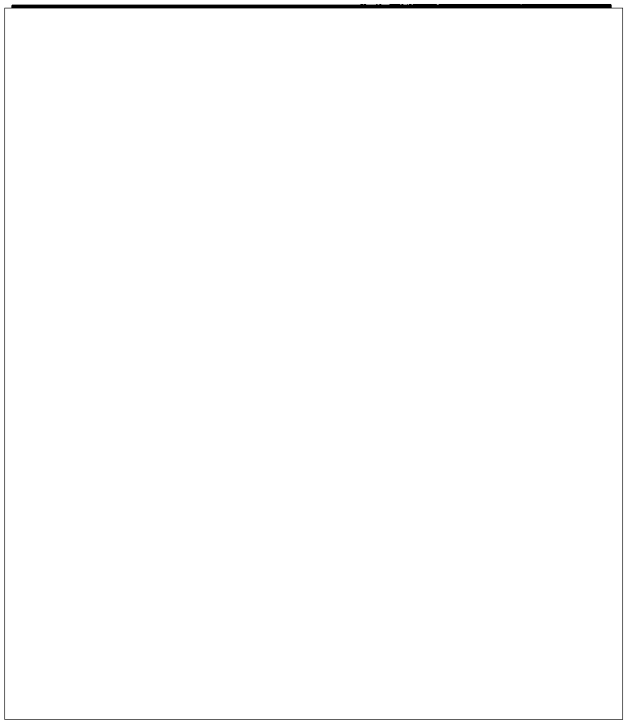
Investment in Housing

Expansion of the repair yards was accompanied by an expansion of the associated housing areas. Accommodations for approximately 42,500 families were built; apartment designs and layouts are typical of the time they were built. They range from four- and five-story apartments of the mid-1960s to elaborate nine- to 12-story high-rise apartments of the late 1970s and early 1980s. These housing areas contain kindergartens, schools, and social centers typical of urban housing areas around major cities. Numerous private automobiles are present (see figure 13). The Soviets have apparently provided significant inducements to bring high-caliber civilian personnel to these often remote areas.

25X1

25X1

25X1



We estimated the construction costs of housing at all Soviet naval repair yards by using our observations of five yards where housing for repair workers could be differentiated from other housing. Construction costs for these housing areas approximately equaled the investment in the associated repair yard within a range of ±8 percent. Two housing areas, Petrovka and Chalmpushka/Roslyakovo, were excluded from the average since the share of housing was very large because of a condition not prevailing at other yards.[21] Using the average of the five yards, we then estimated total housing construction costs by applying the 95-percent factor to the investment in each of the other yards The resulting housing investment was distributed over time (1966-85) in accordance with the observed pace of housing construction at all seven yards.

25X1

25X1

25X1