Scrap metal is any primary metal or alloy that has been used in a device and then recovered for reprocessing and subsequent reuse in another application. When scrap metal has been reprocessed and, as is often the case, combined with newly mined ore, it is considered once again a primary metal and can command a far higher price than it could as scrap. Technically, primary metals are unalloyed metals such as iron, copper, aluminum, and lead. Very often, metal alloys can be of more value than the primary metals themselves. Iron and copper are most often marketed as alloys. Copper alloys, brass and bronze, have been sold in the scrap market for millennia. More recently, alloys of iron, steels of various mechanical properties, have been marketed for subsequent combination with primary metals.

Figure D.1 shows the average weekly U.S. production of steel. As can be seen, total U.S. steel production, some of which is from scrap steel, has been highly variable but has remained at about 2 million long tons per week. Also shown in the figure is the average weekly steel production of the major producers: Pittsburgh, PA, Chicago, IL, and the western United States. These production values average from 200,000 to 500,000 tons per week.

The total rate of U.S. steel production is about 90 percent of the total U.S. steel production capacity, as shown in Figure D.2. These numbers are important to the recycling of Navy and MARAD vessels because they establish that the material introduced to the scrap steel market via ship recycling would not saturate the demand and thus depress scrap metal prices. We estimate that the inventory of ships will introduce about 150,000 tons of scrap steel per year. With the markets being several orders of magnitude larger, this amount will not change the U.S. price of steel.
Figure D.1—Average Weekly U.S. Steel Production

Figure D.2—Utilization of U.S. Steel Production Capacity
FERROUS SCRAP METAL PRICES

Scrap metal prices depend on the scrap class of the metal, whether the scrap is delivered to a broker or directly to a mill, and the city in which the scrap is traded. The more than 100 classes of ferrous scrap depend on the size and thickness of the steel pieces in the lot and the source of the steel (e.g., automobiles, railroad equipment, steel cans). For our analysis we selected heavy melting No. 2 steel 5 feet × 18 inches or under. No matter the grade of steel, the material must be free of dirt, nonferrous metals, foreign material of any kind, and excessive rust and corrosion. The requirement excluding foreign material does not apply to the accidental inclusion of negligible amounts of foreign material where the amount is unavoidable in normal preparation of the alloy. How the steel scrap is delivered has an enormous impact on price. If it is delivered to the steel mill directly on railroad cars in many ton lots rather than to the yard of a broker or exporter it will bring a higher price. The reason for this difference is that the broker or exporter has to incur further transportation costs and must have an allowance profit built into its prices for the raw scrap material. Price will also depend on the city in which the scrap is traded—i.e., the price is directly related to the trading city’s proximity to the mills in which the scrap will be processed. In Pittsburgh, Philadelphia, and Chicago, mills are relatively close. Scrap delivered freight on board (FOB) to these cities can command a far higher price than can scrap delivered to San Francisco, Seattle, or Houston, where a broker or exporter is directly available but the mills are much further away.

Figure D.3 illustrates this relationship, plotting the average monthly price for heavy melting No. 2 steel scrap for the past five years for the six cities just mentioned. The very pronounced difference between the East Coast and West Coast cities is evident. Also evident are the volatility of the price and the price’s general trend of decline since 1995. The average monthly price in October 2000 in Houston, Pittsburgh, and Chicago was about $80 to $90, whereas in Philadelphia it was $60 and on the West Coast it was about $20. All of these prices are in U.S. dollars per long ton FOB mill or broker yard. If a shipbreaker delivers the scrap in the form of modules to a middleman so that it can be further reduced in size for scrap mill processing, the prices decline by roughly half.

To establish an estimate of the scrap steel price for further analysis, we selected prices at cities representative of those that would be likely to handle the ship-breaking of the Navy and MARAD ships: San Francisco, Houston, and Philadel-

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3 Ibid.
We selected Philadelphia over Pittsburgh despite the former’s scrap price being depressed because the additional transportation costs to Pittsburgh of up to $20 per ton could offset the price difference. Moreover, many of the ships in the inactive inventory are stored near Philadelphia and nearby Baltimore. In the average, the Philadelphia price was weighted by a factor of two to account for the abundance of nearby ships. Using October 2000 average prices resulted in a location-weighted average of $53 in current U.S. dollars per long ton for mill-size scrap delivered to the mill. The price for modules delivered to a middleman is half this amount.

NONFERROUS SCRAP METAL PRICES

In addition to ferrous alloys, the Navy and MARAD ships contain nonferrous metals and alloys—aluminum, copper, copper alloys, and lead. Figure D.4 shows the average monthly price for the different classes of aluminum delivered to mills and dealers. Primary metal commands the highest price because, in contrast to the scrap classes, it can be directly used in fabrication. Prices for the scrap classes depend on whether the aluminum is cast or sheet; for the time period shown, they did not vary appreciably. As was true for the ferrous metals, the dealer price for aluminum is below all the prices shown. We selected an
average value for aluminum scrap based on the average October 2000 prices: $725 in current U.S. dollars per long ton.\textsuperscript{4}

For copper we selected the heavy melt No. 2 copper scrap classification as the best descriptor of the copper scrap available from ships.\textsuperscript{5} This classification covers all heavy copper scrap, including heavy wiring and buss bars as well as copper tubing all free of excessive tinning.

Figure D.5 shows the average monthly price for this class of copper for the past five years. As was the case for aluminum, the primary metal commands the highest price and the other classes of scrap command less, how much less depending on the smelter. The unusual property of the price trends here is that the copper scrap prices at the dealer and at the mill are about the same, indicating a more direct connection between scrap price and the primary metal price than was seen for the ferrous alloys. We adopted an average of the October 2000 prices: $1,047 in current U.S. dollars per long ton.

Copper alloys (brass and bronze) have many and diverse applications in ships—everything from manganese-bronze propellers to Monel valve stems and cop-

\textsuperscript{4} Ibid.
\textsuperscript{5} Ibid.
Figure D.5—Average Monthly U.S. Prices for Heavy Melt No. 2 Copper Scrap

Figure D.6—Average Monthly U.S. Prices for Copper Alloy Scrap
per nickel heat exchangers. The average monthly price for brass and bronze scrap is shown in Figure D.6.6.

Because the recovery fractions of copper and copper alloys are uncertain, the average of the copper and copper alloy prices for October 2000 was used, resulting in a value of $972 in current U.S. dollars per long ton.

For lead scrap, the primary metal price has been very volatile over the past five years. However, the price for scrap lead FOB to mill or dealer yard has varied little. We selected the October 2000 price of $213 in current U.S. dollars per long ton.

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6Yellow brass, not used heavily in many ships because it deteriorates in seawater, is not considered in the average values used in the model.