

DEPLETED URANIUM BALANCE WEIGHTS

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The balance weights in the DC-10 and KC-10 ailerons, elevators, and rudder are made of an unusual and interesting metal — depleted uranium. The purpose of this article is to answer some of the more frequently asked questions regarding the balance weights — such as, Why are these parts made from depleted uranium and are they safe to handle?

Lift a piece of depleted uranium and its most obvious feature becomes immediately apparent — it is surprisingly heavy! At 0.68 pounds per cubic inch, depleted uranium is 65 percent heavier than lead. In fact, one cubic foot of depleted uranium weighs an astonishing 1,175 pounds. This com-

pires to a weight of 491 pounds for one cubic foot of steel.

With its high density and sturdy physical properties, depleted uranium offers many unique applications. In addition to its use as aircraft counterweights, depleted uranium is currently being used in such diverse applications as radiation shielding, missile shielding and ballast, and high-energy rotational devices (e.g., gyro rotors and flywheels).

And there are many possible future uses for this metal. For example, an oil well drill collar currently under development utilizes a section of depleted uranium 16 feet long by 7.5 inches in

diameter and weighs 4,800 pounds. Located at the bottom of the drilling column, this unique device has the potential to improve cutting rate, reduce chatter, and helps to keep the drill bit on course. In a similar application, the use of depleted uranium in machine-tool boring bars to control vibration and chatter is presently under development.

Besides the Douglas DC-10 and KC-10, many other commercial and military aircraft use depleted uranium as counterweights in the control surfaces. For example, weights made from this material are also used in the Boeing 747, Lockheed L-1011, C-141, C-130, and C-5A. Another area of aircraft application is its use as blade weights for helicopter rotors.

Counterweights for aircraft control surfaces must fit into limited spaces and yet be very heavy. Although several materials can provide a highly concentrated mass for installation into a small space, depleted uranium is uniquely suited to this purpose. In addition to being very heavy for its size, it can be hot-worked and cold-worked by means of most conventional processes and equipment, it is plentiful, and it is relatively inexpensive.

In its natural state, uranium comprises a very small amount (less than three-fourths of one percent) of the fissionable form of uranium 235, with the balance being uranium 238. Depleted uranium is uranium which has had most of the uranium 235 removed.

Depleted uranium is slightly radioactive. To minimize radiation hazards, the depleted uranium balance weights are 100-percent cadmium plated during the manufacturing process. If the cadmium plating is intact, normal handling of the parts is considered to be nonhazardous and no special safety precautions are recommended.

The use of radioactive materials in many everyday applications is not at all unusual. For example, tritium, a radioactive form of hydrogen, is used in self-luminous signs, such as exit signs, and watches. And thorium, which has a radiation activity level comparable to depleted uranium, is used in making gas mantles for lanterns, electronic equipment, and high-quality optical lenses for cameras and overhead projectors. Also, smoke detectors contain americium 241, a radioactive material.

The main hazard associated with depleted uranium is the harmful effect the material could have if it enters the body. If particles of the parent metal or its oxides are inhaled or ingested, they can be chemically toxic and can cause a signifi-

cant and long-lasting irradiation of internal tissue. Thus, the cadmium plating on the depleted uranium balance weights serves not only to attenuate radiation emissions, but also to provide corrosion prevention (unprotected depleted uranium corrodes fairly rapidly, producing a black, dusty oxide).

It should be noted that depleted uranium is not unique in regards to its chemical toxicity. Indeed, chemical toxicity is a trait shared by most heavy metals (lead, nickel, copper, etc.). Care should be taken to avoid breathing or swallowing particles of *any* heavy metal.

No penetration of the plating on the depleted uranium balance weights is allowed. Whenever the protective cadmium plating is breached, the weight must be removed from the aircraft and sent to a qualified vendor (N. L. Industries, Inc., 1130 Central Avenue, Albany, New York, 12205) for replating or disposal. When it is not possible to follow this recommended procedure, an interim rework (clean/paint) procedure must be implemented. But this interim measure is only intended to give the operator additional time to schedule the balance weight for proper replating. Refer to the appropriate *DC-10 Maintenance Manual* chapter for instructions on cleaning/painting aileron, elevator, and rudder weights — chapter 57-51-02 for aileron weights, chapter 55-21-01 for elevator weights, and chapter 55-41-01 for rudder weights.

NOTE

Disposal of the depleted uranium balance weights can only be undertaken by a licensed recipient. They cannot be scrapped by a scrap dealer or processor.

The balance weights must not be sanded, filed, drilled, reamed, or reworked in any way to accomplish installation. The weights should fit well enough to be simply bolted into place or, in some cases, the support structure must be modified or replaced to accomplish installation. *Never* rework the balance weights themselves.

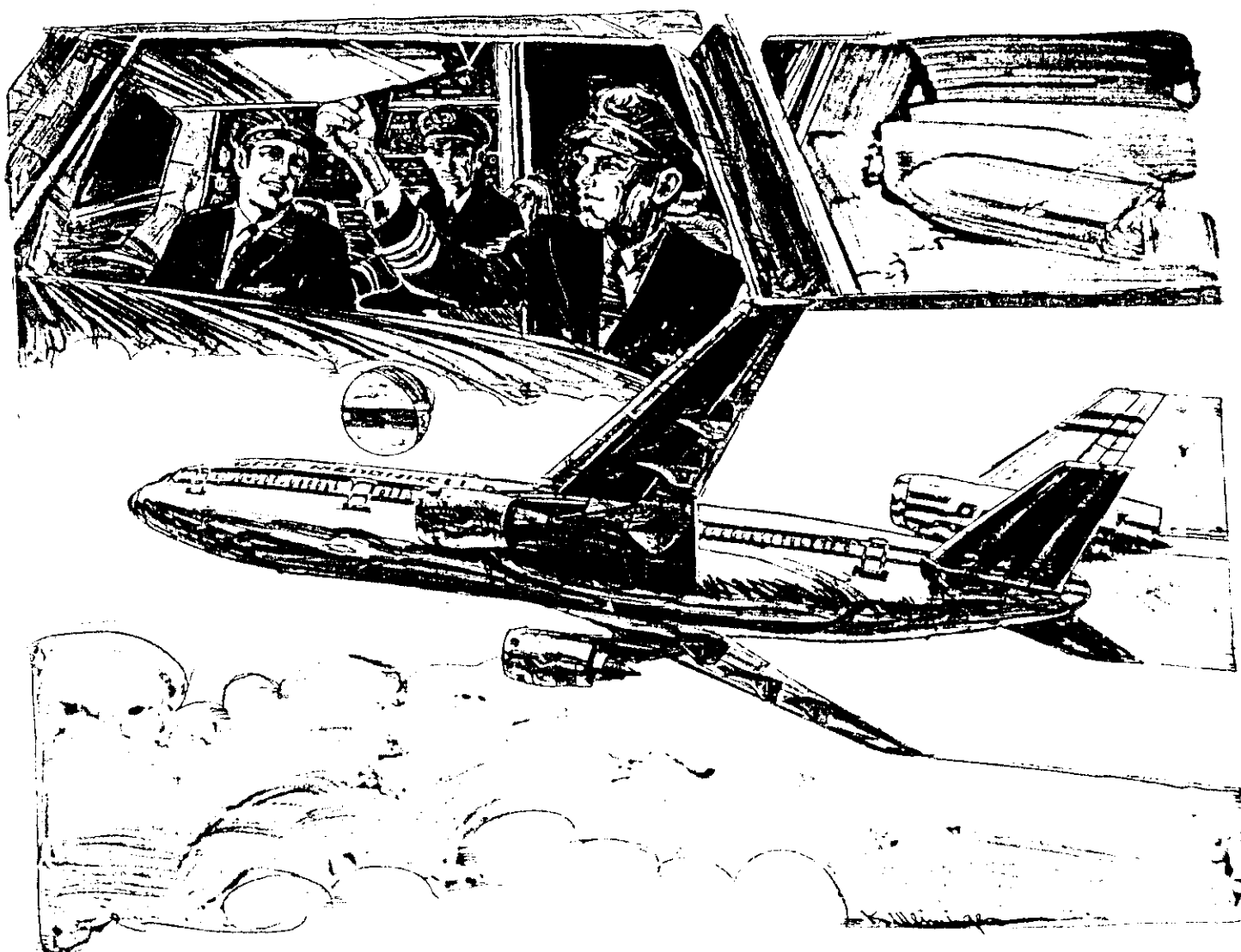
And remember, the balance weights are deceptively heavy. Use caution when picking one of them up to avoid dropping it. Dropping a balance weight would more than likely damage the cadmium plating, necessitating the return of the part to a vendor for replating.

Because several operators have reported corrosion on the DC-10 aileron, elevator, and

rudder depleted uranium balance weights. Douglas has issued two service bulletins to install aluminum shields and sealant on the weights. The corrosion occurs when a portion of the protective cadmium plating is removed through weather erosion, mechanical damage, or poor adhesion. Installing protective shield assemblies to provide impact protection and sealing the weights minimizes the probability of corrosion damage. See *Service Bulletin 57-68*, "Modify Outboard Aileron Balance Weights," and *Service Bulletin 55-11*, "Install Shield Assemblies on Balance Weights for Corrosion Protection." See figures 1, 2, and 3 for the location and part numbers of the balance weights modified by *Service Bulletins 57-68* and *55-11*.

In summary, depleted uranium is used for the

balance weights in many aircraft because of its high density and other desirable features. The cadmium plating on the balance weights serves to attenuate radiation emissions, and to provide corrosion prevention. No penetration of the cadmium plating is permitted. If the cadmium plating is intact, normal handling of the parts is considered to be nonhazardous and no special safety precautions are recommended. If the plating is breached, the part must be sent to a qualified vendor for replating. When it is not possible to immediately replate a damaged balance weight, the part may be temporarily repaired by a cleaning/painting procedure in accordance with the *DC-10 Maintenance Manual*. No other work of any kind is allowed on the depleted uranium balance weights.



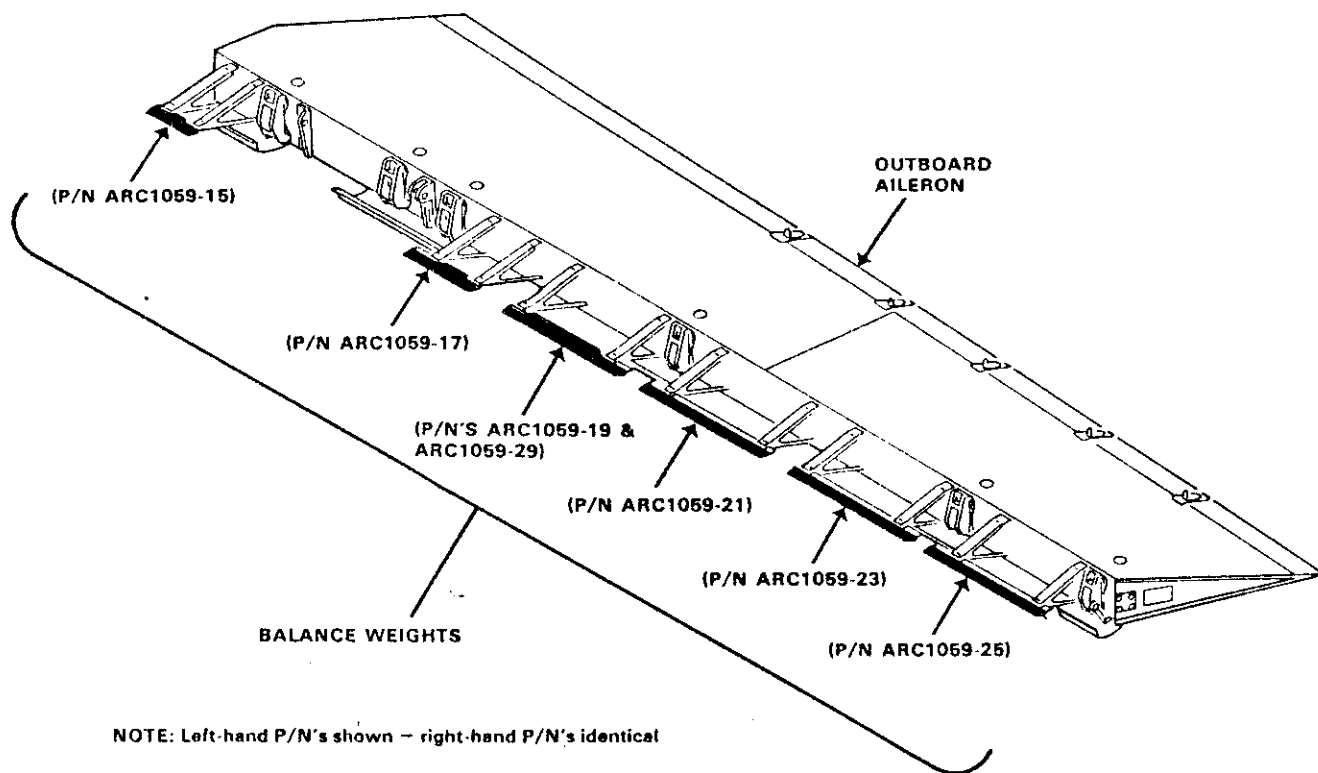
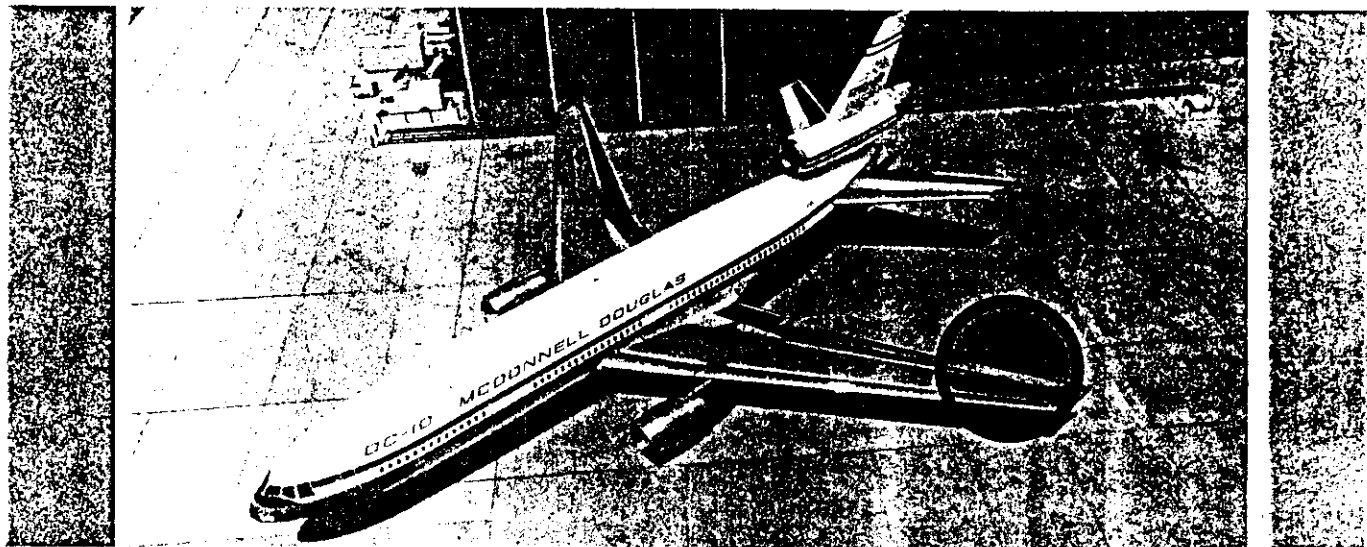


Figure 1. Outboard Aileron Balance Weight Installations

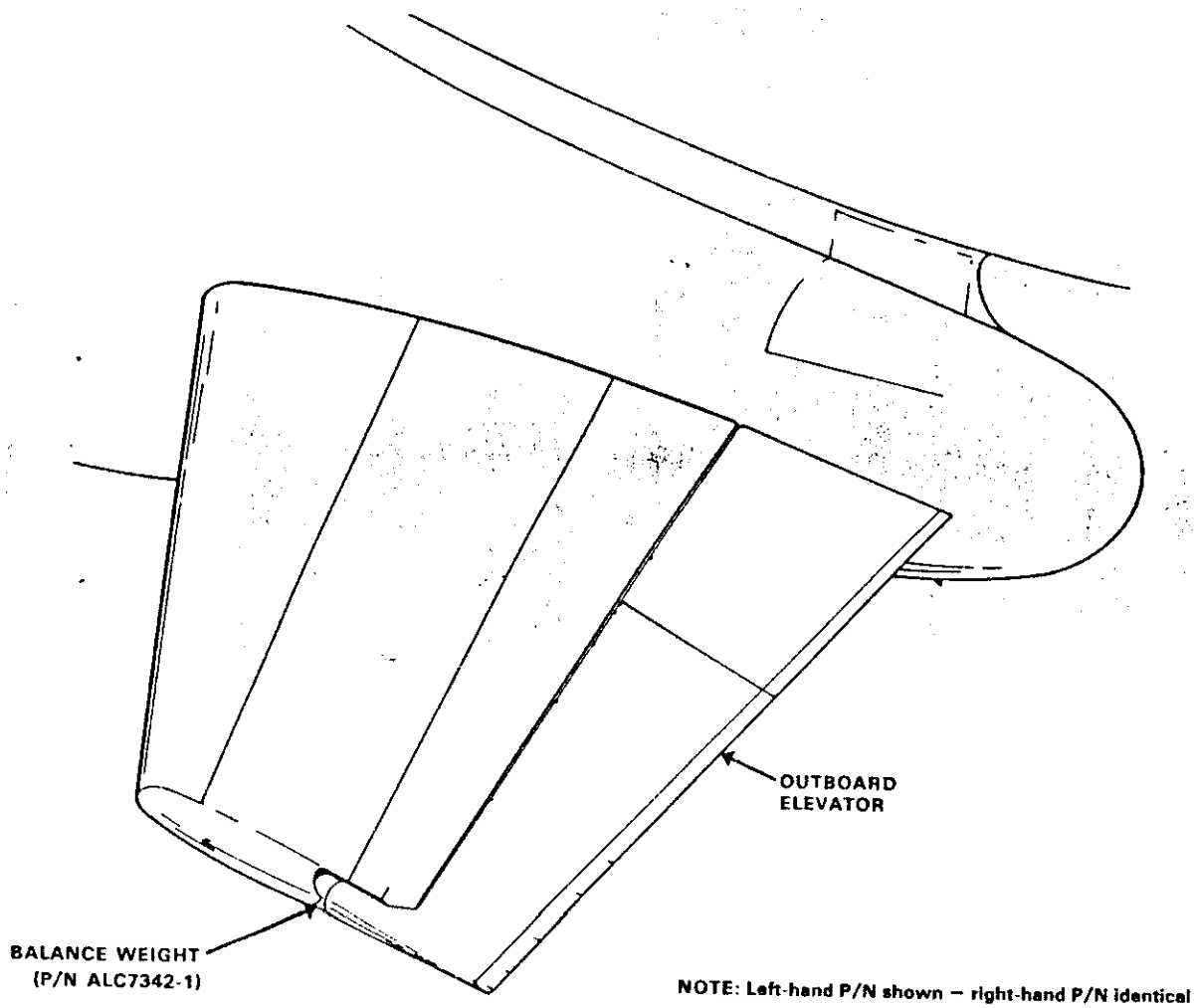
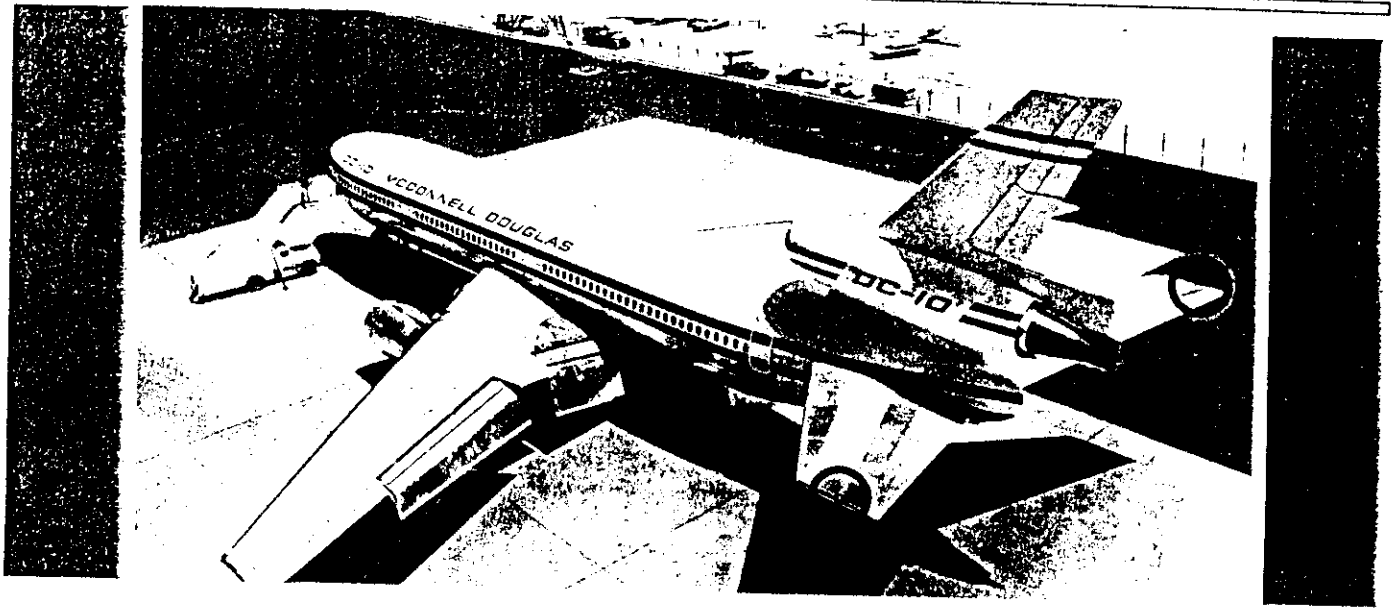


Figure 2. Outboard Elevator Balance Weight Installation

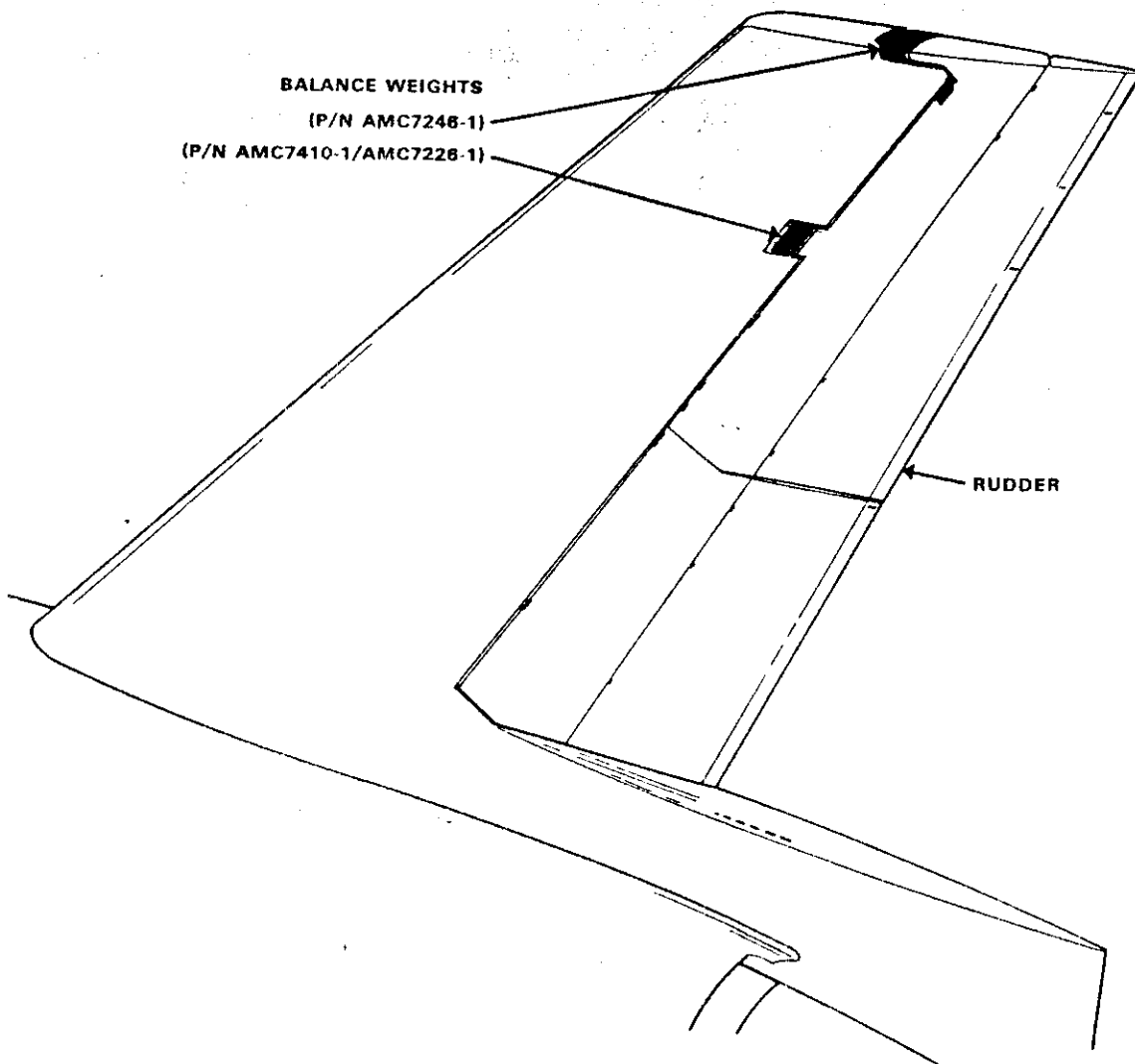
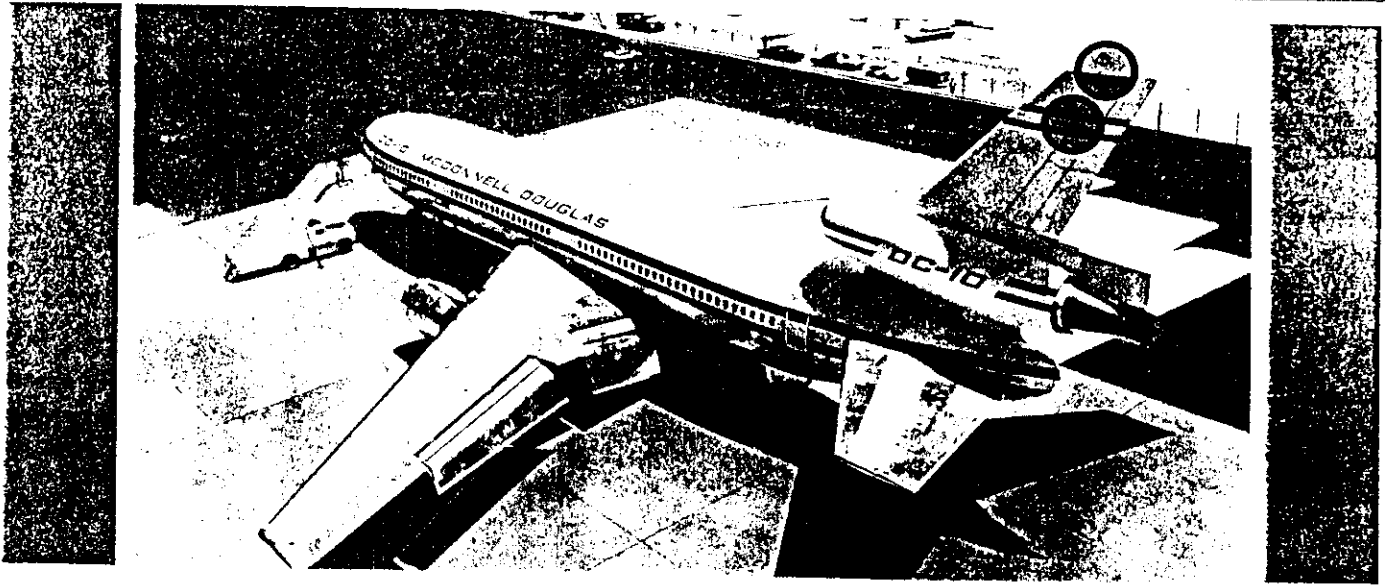


Figure 3. Rudder Balance Weight Installations