Clockwise from top: McDonnell Douglas blended wing-body, Lockheed spanloader, Airbus Super Transporter, Lockheed Very Large Airplane and Molniya 1000 Heracles.

all, a similar revolution began 40 years ago, when the jet airliner lured long-distance travelers from the passenger ship. What the Boeing 707 did for trans-Atlantic passage, many argue, a new breed of all-cargo megajet could do for international trade—spur the growth of a huge new market drawn by speed and convenience.

Economics will determine how quickly and thoroughly this dream becomes reality. But America's aeronautics experts aren't waiting passively in the wings. At NASA's Langley Research Center, engineers are beginning to hammer out technology requirements. Meanwhile, at NASA's behest, manufacturers are already sketching aircraft that would overshadow today's flying beast of burden, the Boeing 747-400F. And at the Massachusetts Institute of Technology, research is under way on the infrastructure—terminals, runways, cargo-handling gear—needed to usher in a new age of air freight.

At the center of all this brainstorming is the group of NASA-Langley aeronautical engineers led by

Shelby J. Morris. Right now, admits Morris, thinking about future air freighters prompts more questions than answers.

"We're looking, in a preliminary way, at very large airplanes," he says. "We think largeness has a virtue up to a certain point, but we're not sure exactly how large is large enough and how large is too large. And we're exploring the technologies associated with these airplanes, including radically different airframe shapes."

The blended wing-body (BWB) certainly qualifies as such. Conceived by McDonnell Douglas Aerospace (see Tech Update, page 16, April '94), its batlike silhouette emerged from a challenge, issued by NASA, to look beyond the winged-cylinder configuration that has typified transport aircraft since the 707.

The BWB began as a design for an 800-passenger, 7000-mile airliner. "But it turns out it works very well as a cargo airplane," says McDonnell Douglas's Bob Liebeck. "It has a large cabin that's very versatile in its layout. If you didn't need the cargo pressurized, you could build it very light." Liebeck envisions a cargo variant laid out like the passenger version: two decks stacked inboard with single decks out toward the wings.

In designing the aircraft, Liebeck and company assumed the technology of 2015—an all-composite structure, either three or four big ducted-fan engines, "fly-by-light" fiberoptic controls and the relaxed static stability seen today in the B-2 bomber. According to a McDonnell Douglas analysis, the BWB would outperform an equivalent conventional aircraft—such as a double-decker Boeing 747—that featured the same technology.

Even more radical is the spanloader, a concept that surfaced in the late 1970s when NASA last sponsored a major study of future cargo planes.

Airbus Super Transporter dwarfs Super Guppy during rollout. Oversize fuselage is scaled to swallow airframe components.

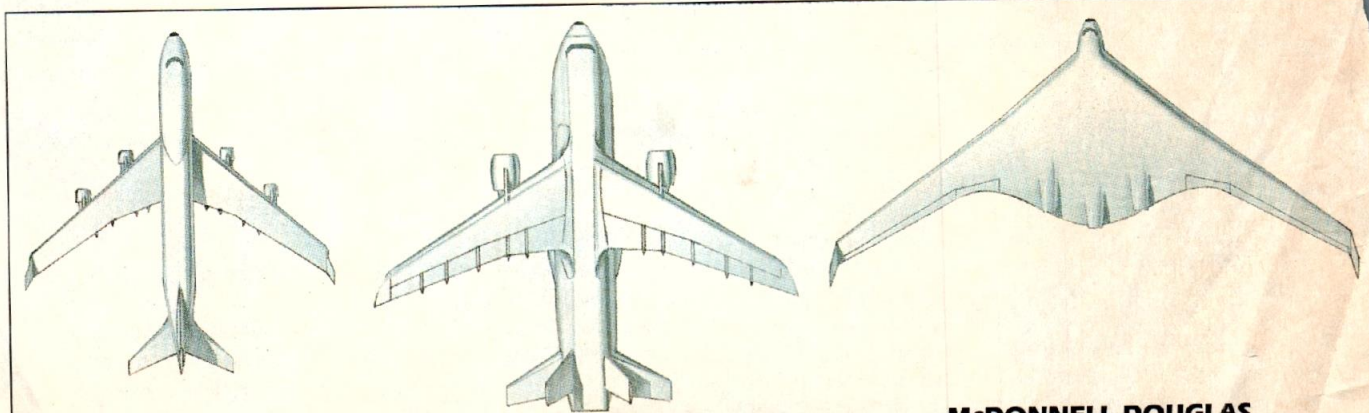
AIRBUS PHOTO

In this configuration, cargo takes up space inside the aircraft's gigantic wings. Spanloader anatomy minimizes the distance between aerodynamic lift forces and the payload to be lifted, thus reducing structural reinforcement and hence the airplane's weight. Lockheed Aeronautical Systems Co. has recently considered a spanloader sized to carry 600,000 pounds over 3000 miles.

Lockheed is also toying with a more traditional silhouette in a vehicle known simply as the Very Large Airplane. Something like a mammoth C-5 Galaxy, the aircraft could play three roles at once: cargo, passenger and military airlift. "If one thinks about multiple uses early enough in the design process," says Lockheed's Tony Hays, "there may be a way to satisfy all these requirements without significant compromise." This approach veers from the conventional route taken by Boeing, McDonnell Douglas and Airbus—each of which has plans for a superjumbo of at least 600 seats, an airliner that might later be pressed into freighter service.

Payload payoff

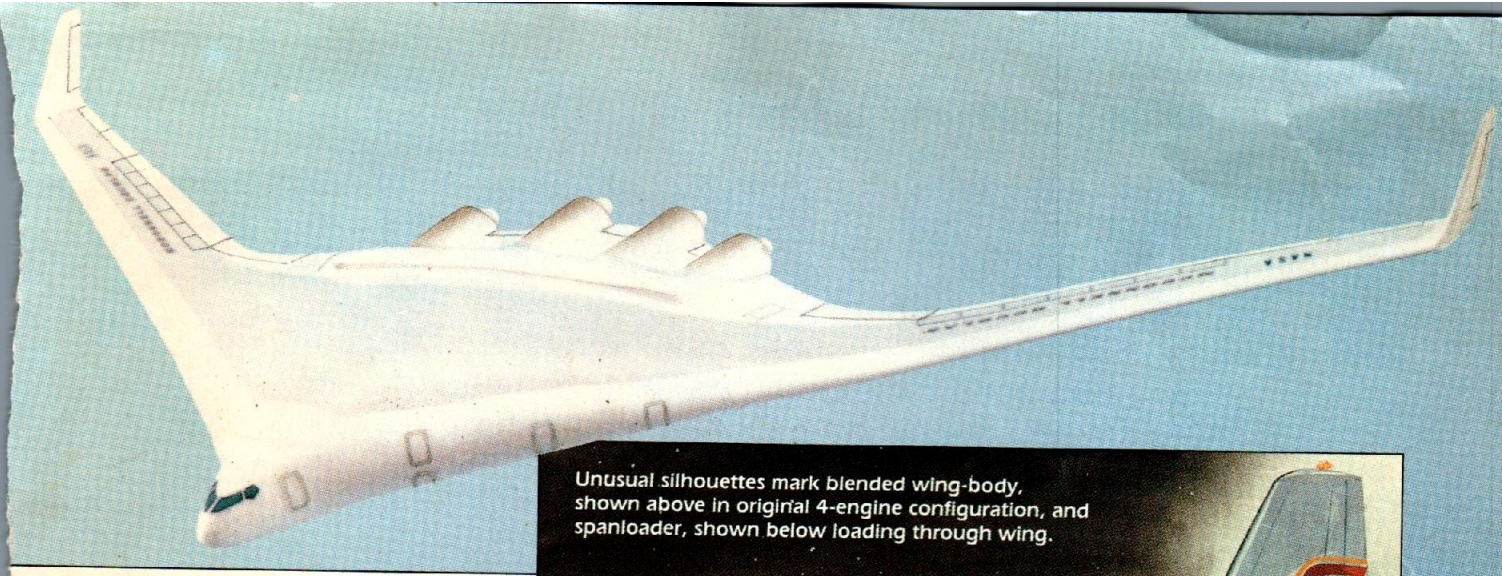
One thread common to the tailoring of these planes is their accommodation of intermodal cargo containers. Those are the standardized 8 × 8 × 20-ft. or 8 × 8 × 40-ft. steel boxes hauled by ship, train and truck alike. The Boeing 747-400F can swallow only 14 alu-



BOEING 747-400F
WINGSPAN: 213 FT.
LENGTH: 231 FT.
MAXIMUM PAYLOAD: 280,000 LB.

LOCKHEED VERY LARGE AIRPLANE
WINGSPAN: 281 FT.
LENGTH: 262 FT.
MAXIMUM PAYLOAD: 410,000 LB.

McDONNELL DOUGLAS BLENDED WING-BODY
WINGSPAN: 280 FT.
LENGTH: 172 FT.
MAXIMUM PAYLOAD: 300,000 LB.



Unusual silhouettes mark blended wing-body, shown above in original 4-engine configuration, and spanloader, shown below loading through wing.

LOCKHEED ILLUSTRATION

minum versions of the 20-ft.-long containers, while a typical container ship can take on 4000. For the air-cargo market to support development of giant freighters, researchers believe, the planes must be optimized to handle intermodal containers.

Outsized consignments defy containerization, however. To get such shipments airborne calls for a special-purpose sky freighter. One, in fact, made its maiden flight last September. The Airbus Super Transporter (AST) —an A300 modified with a whaleback fuselage—offers a record 50,000 cu. ft. of main-deck cargo volume, more than either the Lockheed C-5 or the Antonov An-225. Airbus has planned a fleet of four ASTs, replacing the 40-year-old Super Guppies, to whisk aircraft-fuselage sections between assembly facilities in Europe.

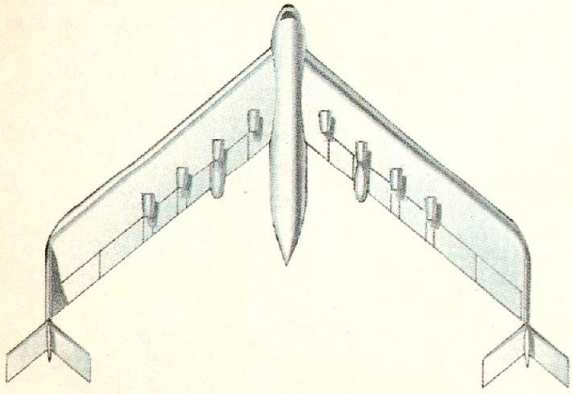
Russia's Molniya Scientific and Industrial Enterprise also targets bulky payloads with its proposed Heracles heavy lifter. Three wings, two fuselages and six engines would create the world's strongest airplane—able to lift 992,060 pounds and roar skyward weighing nearly 1000 tons. A removable payload canister would nestle between the fuselages.

Landing trouble

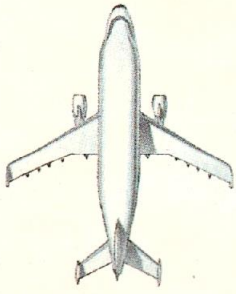
The sheer size of all these proposed aircraft raises questions. "It's going to be tough to get these very large airplanes into existing airports," says Robert Simpson, director of MIT's Flight Transportation Laboratory. "It's going to mean moving taxiways and tearing down buildings and folding wings. And the strength of the runways becomes a problem."

Simpson has aired a novel solution —landing amphibious freighters on pier-lined lakes. While this idea intrigues the NASA-Langley group, they point out complications from corrosion —and the fixed geography of lakes. Location of an air-freight port is critical to the concept. "The system wants to go midcontinent to midcontinent," notes Simpson, "trying to save time and money by avoiding the train."

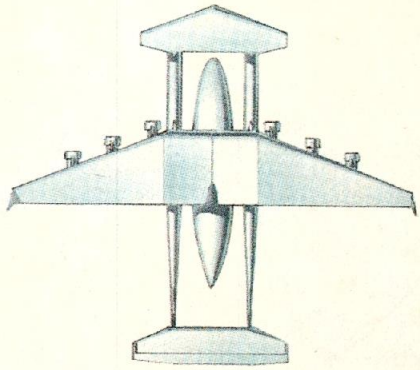
Time and money will ultimately dictate the success of the sky-freight revolution. Boeing predicts air cargo growing at a rate of 6.5% a year, which triples the tonnage by the year 2013. Already air transport attracts shippers for whom the added cost is outweighed by their cargoes' short-lived market value. These include garments, electronics and other items with fickle customers and fast-changing models. For these businesses, time is money, and time flies. So as industry's pace continues to gather speed, look for the titans of transport to deliver the goods. **PM**



LOCKHEED SPANLOADER
WINGSPAN: 331 FT.
LENGTH: 256 FT.
MAXIMUM PAYLOAD: 600,000 LB.



AIRBUS SUPER TRANSPORTER A300-600ST
WINGSPAN: 147 FT.
LENGTH: 184 FT.
MAXIMUM PAYLOAD: 100,309 LB.



MOLNIYA 1000 HERACLES
WINGSPAN: 295 FT.
LENGTH: 240 FT.
MAXIMUM PAYLOAD: 992,060 LB.

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NASA ILLUSTRATION (TOP)