Hot air balloons might not seem like advanced technology, but engineers still design new floating aircraft, as in this article from Popular Science magazine:

The Flying Luxury Hotel

This is not a Blimp. It's a sort of flying cruise ship that could change the way you think about air travel. It's the Aeroscraft, and when it's completed, it will carry passengers across continents and oceans as they stroll leisurely about the one-acre cabin or relax in their well-appointed rooms.

Unlike its blimp ancestors, the Aeroscraft is not lighter than air. Its 14 million cubic feet of helium hoist only two thirds of the craft's weight. The rigid and surprisingly aerodynamic body—driven by huge rearward propellers—generates enough additional upward force to keep the Aeroscraft aloft while cruising. During takeoff and landing, six turbofan jet engines push the ship up or ease its descent.

This two-football-fields-long concept airship is the brainchild of Igor Pasternak, whose privately-funded California firm, Worldwide Aeros Corporation, is in the early stages of developing a prototype and expects to have one completed by 2010. Pasternak says several cruise ship companies have expressed interest in the project, and for good reason: The craft would have a range of several thousand miles and, with an estimated top speed of 174 mph, could traverse the continental U.S. in about 18 hours. During the flight, passengers would peer at national landmarks just 8,000 feet below or, if they weren't enjoying the view, the enormous interior would easily accommodate such amenities as luxury hotel rooms, restaurants, even a casino.

To minimize noise, the aft-mounted propellers will be electric. A sophisticated buoyancy-management system will allow precise adjustments in flight, to adjust for outside conditions and passenger movement. An automated system will pump outside air into compartments throughout the ship and compress it to change the craft's weight.

The company envisions a cargo-carrying version that could deliver a store's worth of merchandise from a centralized distribution center straight to a Wal-Mart parking lot or, because the helium-filled craft will float, a year's worth of supplies to an offshore oil rig. "You can land on the snow, you can land on the water," Pasternak says. "It's a new vision of what can be done in the air."

Aeroscraft
Purpose: Long-range travel for passengers who are more concerned with the journey than the destination
Dimensions (feet): 165 h x 244 w x 647 l
Max Speed: 174 mph
Range: 6,000 miles
Capacity: 250 passengers

Adapted from: Joshua Tompkins, "The Flying Luxury Hotel", Popular Science, 2005.

Questions:

1. What gas does the Aeroscraft use to help it float in air?

2. What did the Aeroscraft engineers change from a regular airplane that helps it float? Think about mass and volume.

3. Even with a light gas inside, the Aeroscraft needs additional force to lift-off. Where does this force come from?