$$(\partial_t - ix)\mathbf{b} = -\frac{3}{2\bar{\omega}_A} b_x \hat{y} + i\mathbf{u} \tag{1}$$

$$(\partial_t - ix)\mathbf{u} = \frac{2}{\bar{\omega}_A} u_y \hat{x} - \frac{1}{2\bar{\omega}_A} u_x \hat{y} - \frac{3}{2\bar{\omega}_A} \partial_x Q \hat{x} - iQ\hat{y} - i\frac{1}{\kappa} Q\hat{z} + i\mathbf{b} \tag{2}$$

$$\frac{3}{2}\partial_x u_x + i\bar{\omega}_A u_y + \frac{i\bar{\omega}_A}{\kappa} u_z = 0 \tag{3}$$

This last equation may look a little odd but it is really just $\nabla \cdot \mathbf{b} = 0$ after making the original equations dimensionless.

After putting them in component form:

$$\frac{\partial}{\partial t} b_x = ixb_x + iu_x$$

$$\frac{\partial}{\partial t} b_y = ixu_y - \frac{3}{2\bar{\omega}_A} b_x + iu_y$$

$$\frac{\partial}{\partial t} b_z = ixb_z + iu_z$$

$$\frac{\partial}{\partial t} u_x = ixu_x + \frac{2}{\bar{\omega}_A} u_y - \frac{3}{2\bar{\omega}_A} \frac{\partial Q}{\partial x} + ib_x$$

$$\frac{\partial}{\partial t} u_y = ixu_y - \frac{1}{2\bar{\omega}_A} u_x - iQ + ib_y$$

$$\frac{\partial}{\partial t} u_z = ixu_z - \frac{i}{\kappa} Q + ib_z$$

Subscripts x,y and z indicate the x,y and z components of **b** and **u**.

Q is found by taking the divergence of (2) to get

$$\frac{\partial^2 Q}{\partial x^2} - K^2 Q - F = 0$$

where $K^2 = \frac{4}{3} i\bar{\omega}_A \sqrt{1 + \frac{1}{\kappa^2}}$ and $F = \frac{4}{3}\frac{\partial u_y}{\partial x} + \frac{4i\bar{\omega}_A u_x}{9}$

The initial conditions are

$$b_x(x,0) = e^{-x^2}$$

$$b_y(x,0) = \frac{3i}{2\bar{\omega}_A} \frac{\partial b_x(x,0)}{\partial x}$$

$$b_z(x,0) = u_x(x,0) = u_y(x,0) = u_z(x,0) = 0$$

With everything going to zero at infinity. As for Q, it should go to zero at + and - infinity as well.