



Basic Diving Physics

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High Impact Visual Tools for the Marine and Diving Sciences

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Disclaimer

Prior to engaging in any extended range diving activities, person(s) must be first qualified and certified by a recognized training agency.

The material found in this program is only intended to promote and augment that training.

Information in this program is subject to change according to developing occupational practices. It is therefore required that anyone presenting this material first ensure that it meets current industry standards

Before we begin...

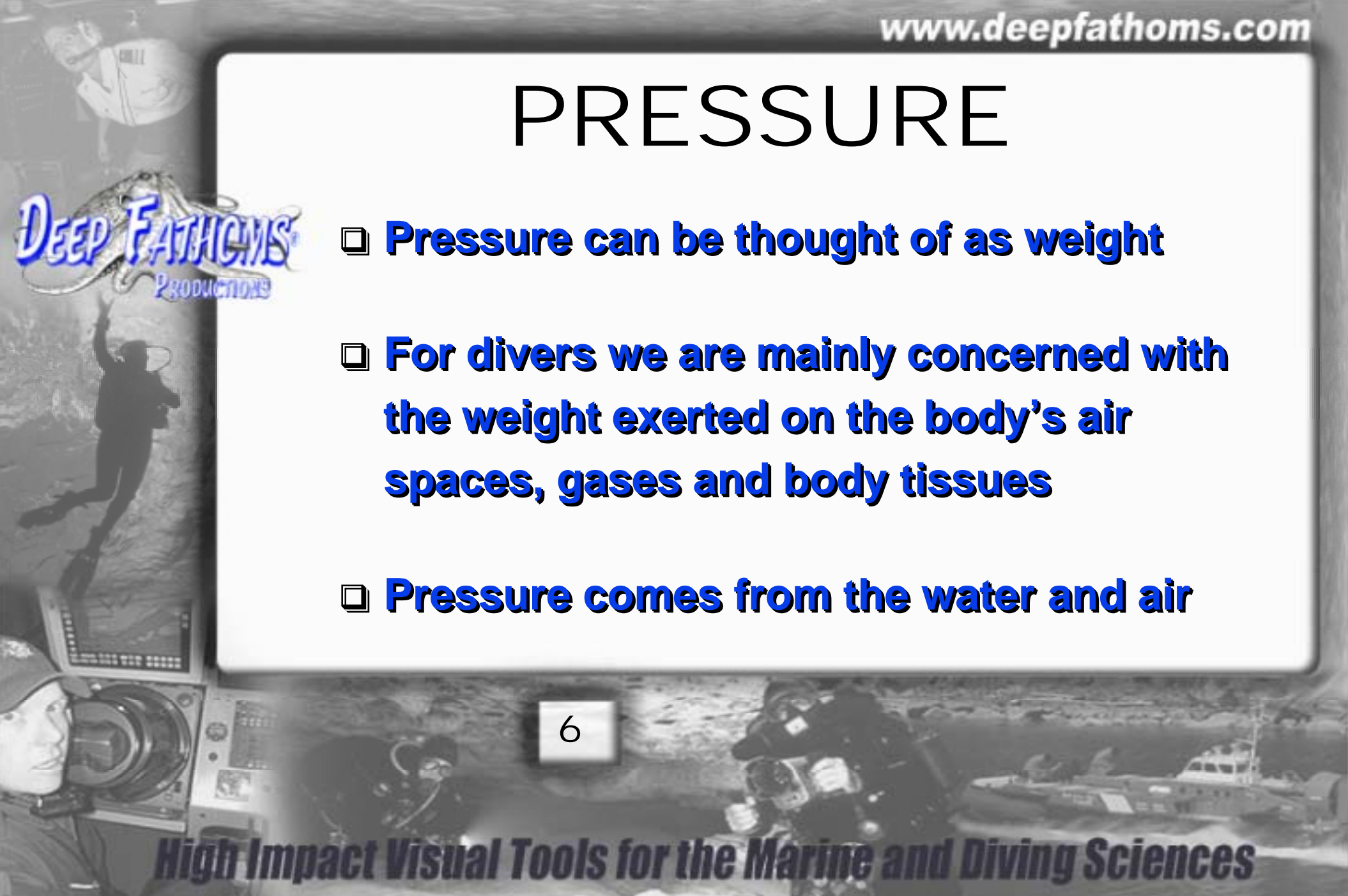
- ✓ As a courtesy please turn off all cell phones and pagers
- ✓ Location of washrooms, amenities, parking, and emergency exit protocol
- ✓ Breaks, meals and general class rules
- ✓ Your participation is expected, questions and group discussion are encouraged

Basic Diving Physics

- **Competent divers need to understand the physiological implications of diving and maintain control in the water**
- **This requires an intimate understanding of basic diving Physics**

PRESSURE

- ❑ **Pressure can be thought of as weight**
- ❑ **For divers we are mainly concerned with the weight exerted on the body's air spaces, gases and body tissues**
- ❑ **Pressure comes from the water and air**



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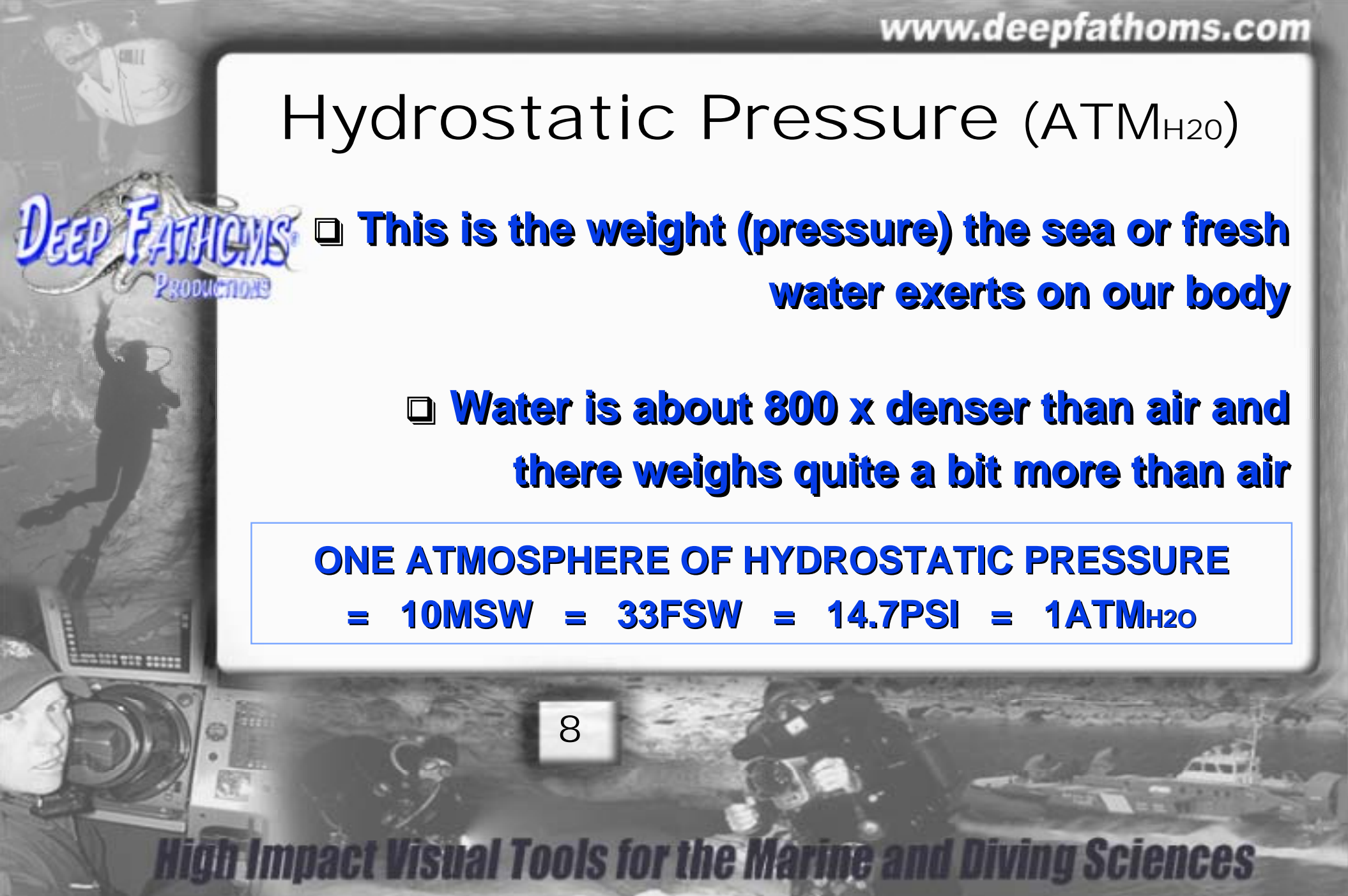
Atmospheric Pressure (ATM_{Air})

- ❑ **This is the weight (pressure) the atmospheric air exerts on our body**
- ❑ **It is 14.7psi or 1 Bar at sea level**
- ❑ **We do not notice it for the most part because we have adjusted to it**

Hydrostatic Pressure (ATM_{H_2O})

- **This is the weight (pressure) the sea or fresh water exerts on our body**
- **Water is about 800 x denser than air and there weighs quite a bit more than air**

**ONE ATMOSPHERE OF HYDROSTATIC PRESSURE
= 10MSW = 33FSW = 14.7PSI = $1ATM_{H_2O}$**



Absolute Pressure (ATA)

ATMOSPHERIC PRESSURE (ATMAIR)

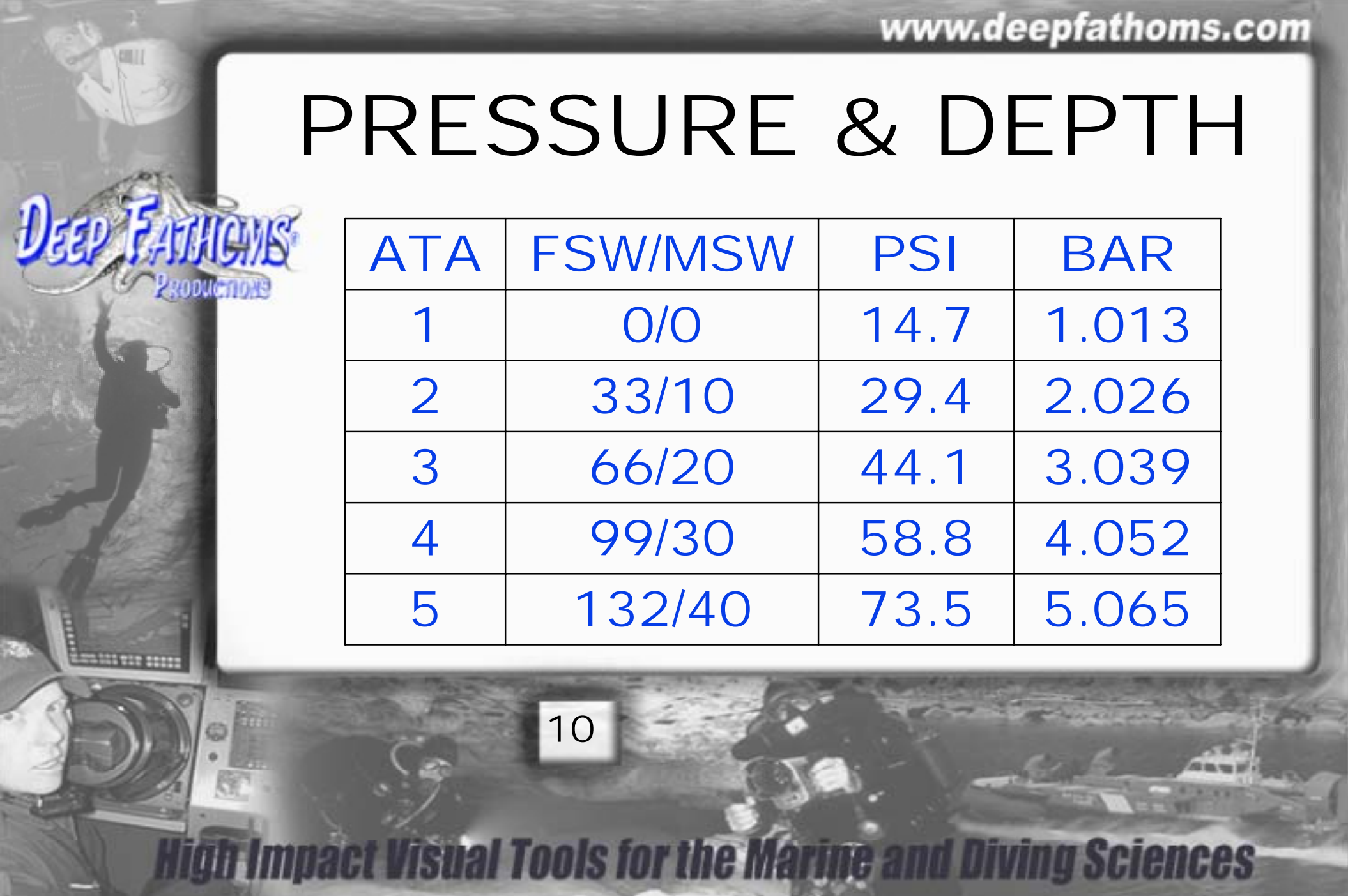
+

HYDROSTATIC PRESSURE (ATMH₂O)

= ABSOLUTE PRESSURE (ATA)

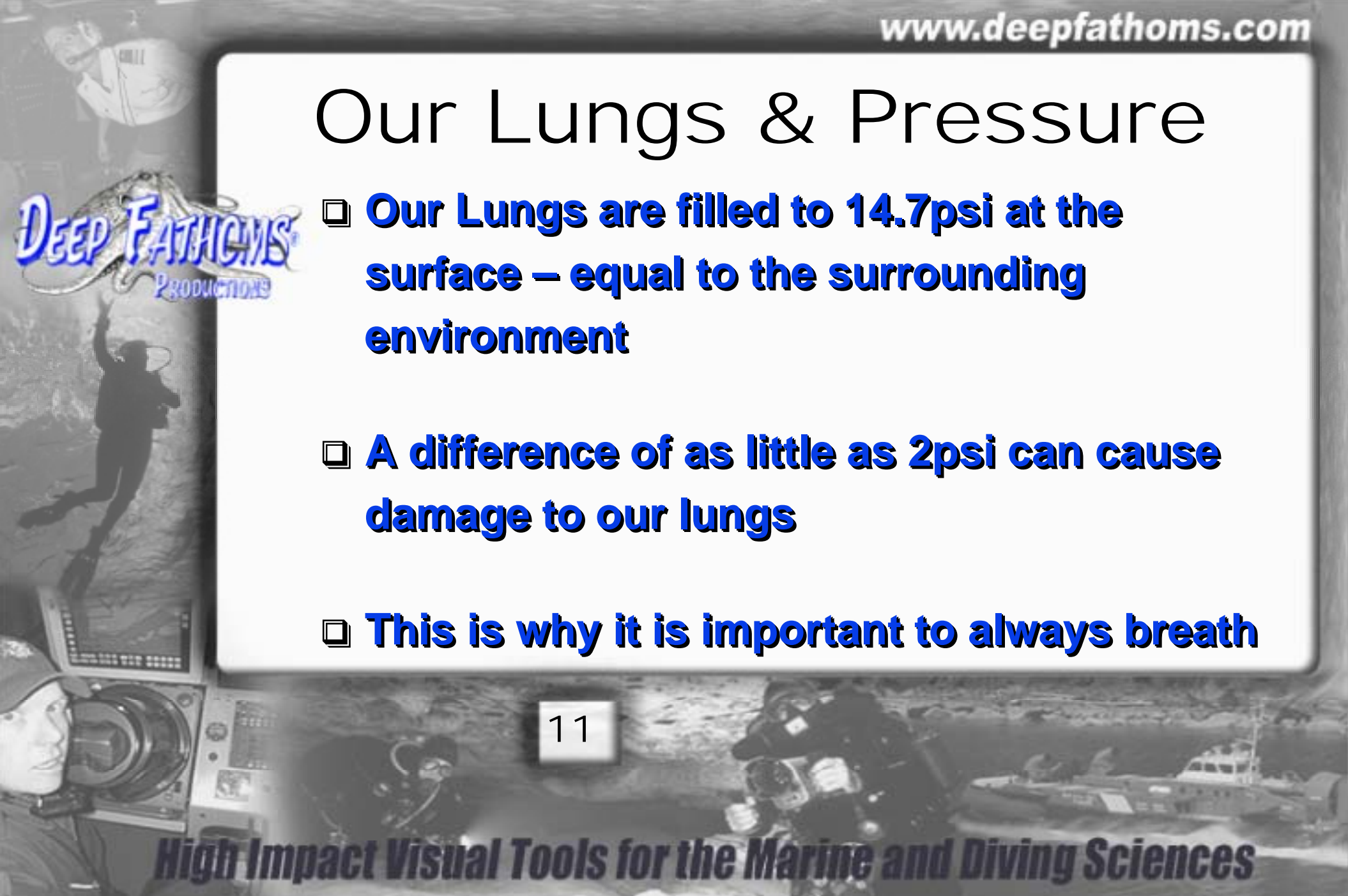
PRESSURE & DEPTH

ATA	FSW/MSW	PSI	BAR
1	0/0	14.7	1.013
2	33/10	29.4	2.026
3	66/20	44.1	3.039
4	99/30	58.8	4.052
5	132/40	73.5	5.065



Our Lungs & Pressure

- ❑ **Our Lungs are filled to 14.7psi at the surface – equal to the surrounding environment**
- ❑ **A difference of as little as 2psi can cause damage to our lungs**
- ❑ **This is why it is important to always breath**



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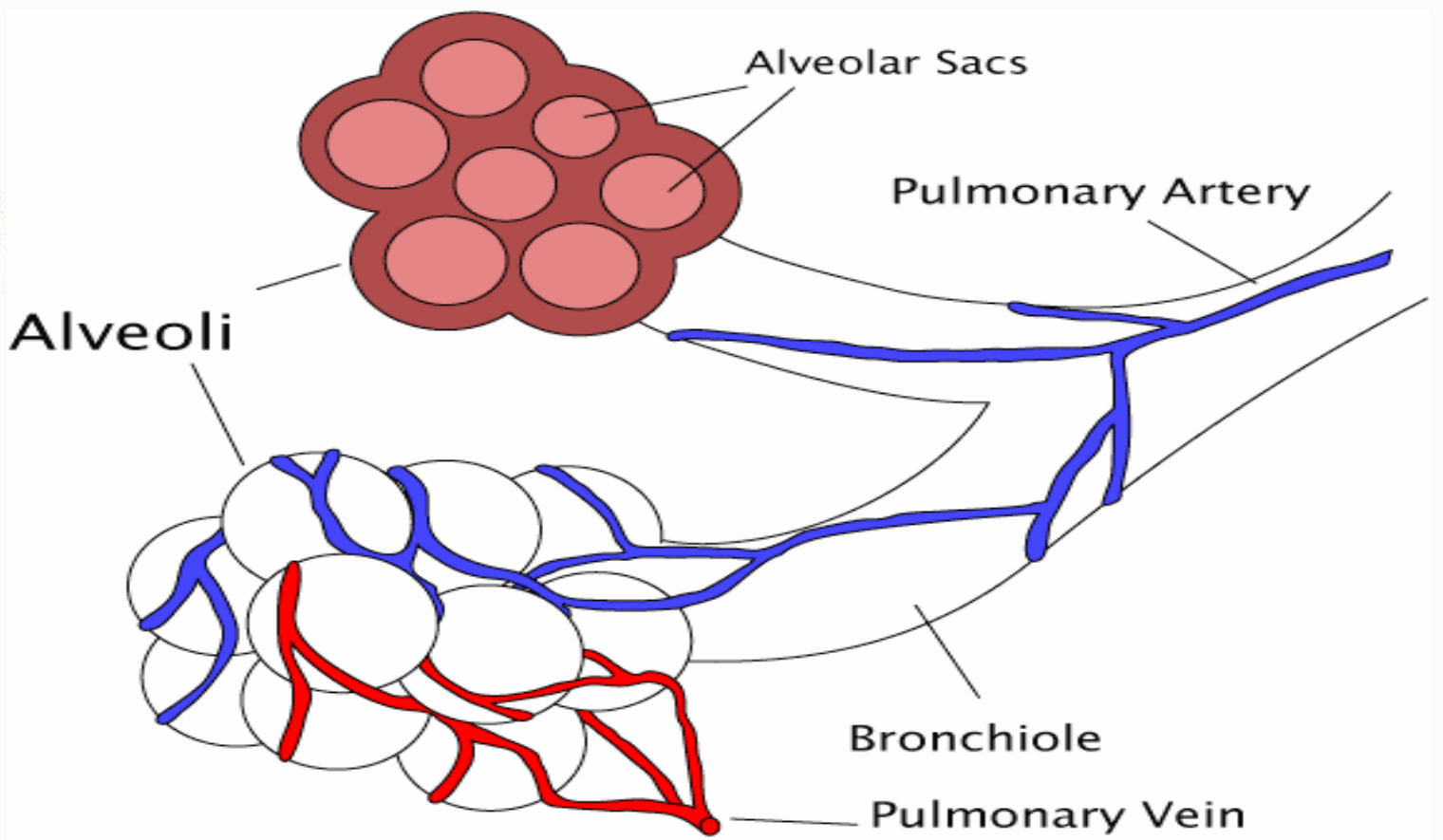
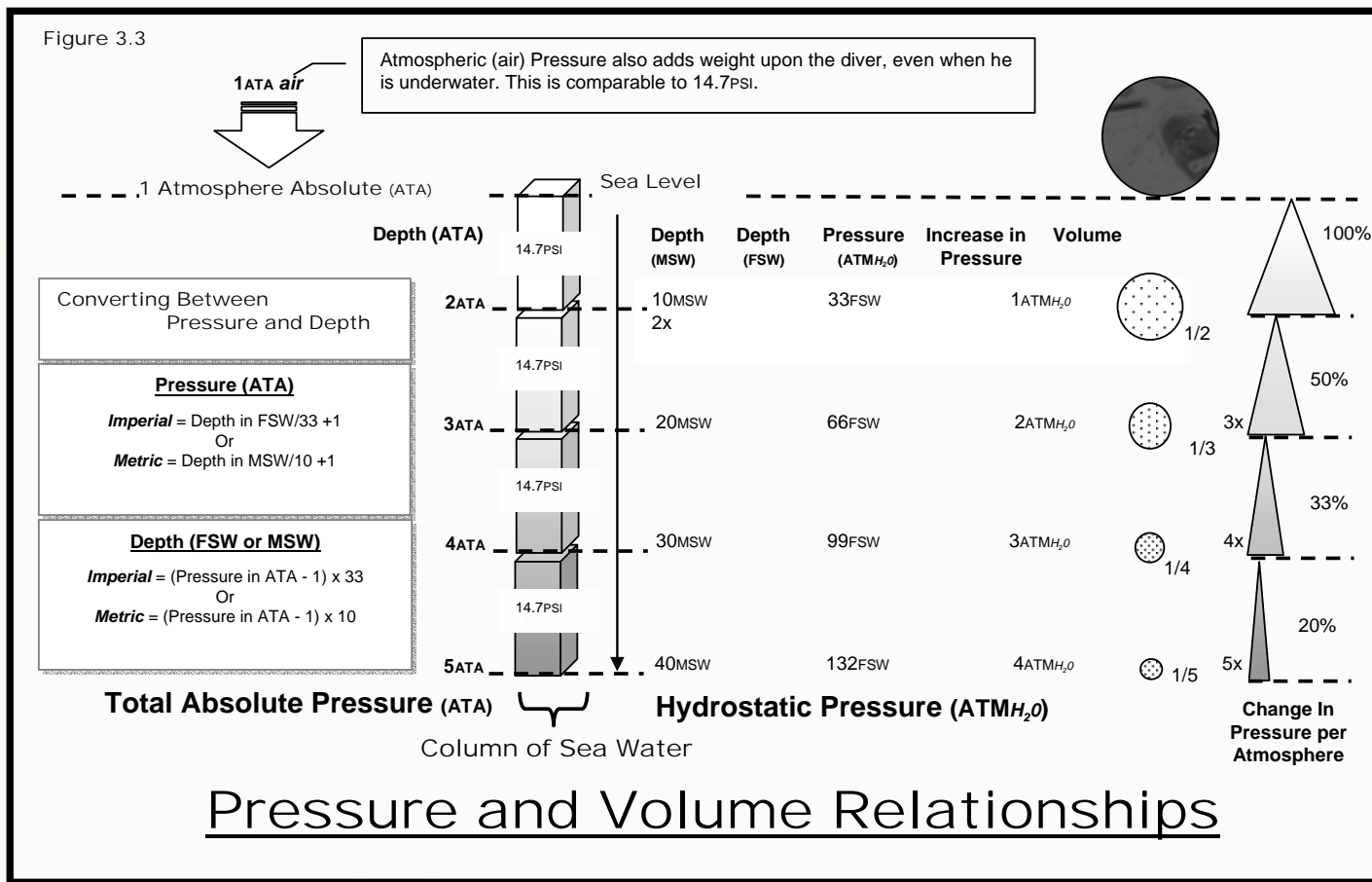


Figure 3.3

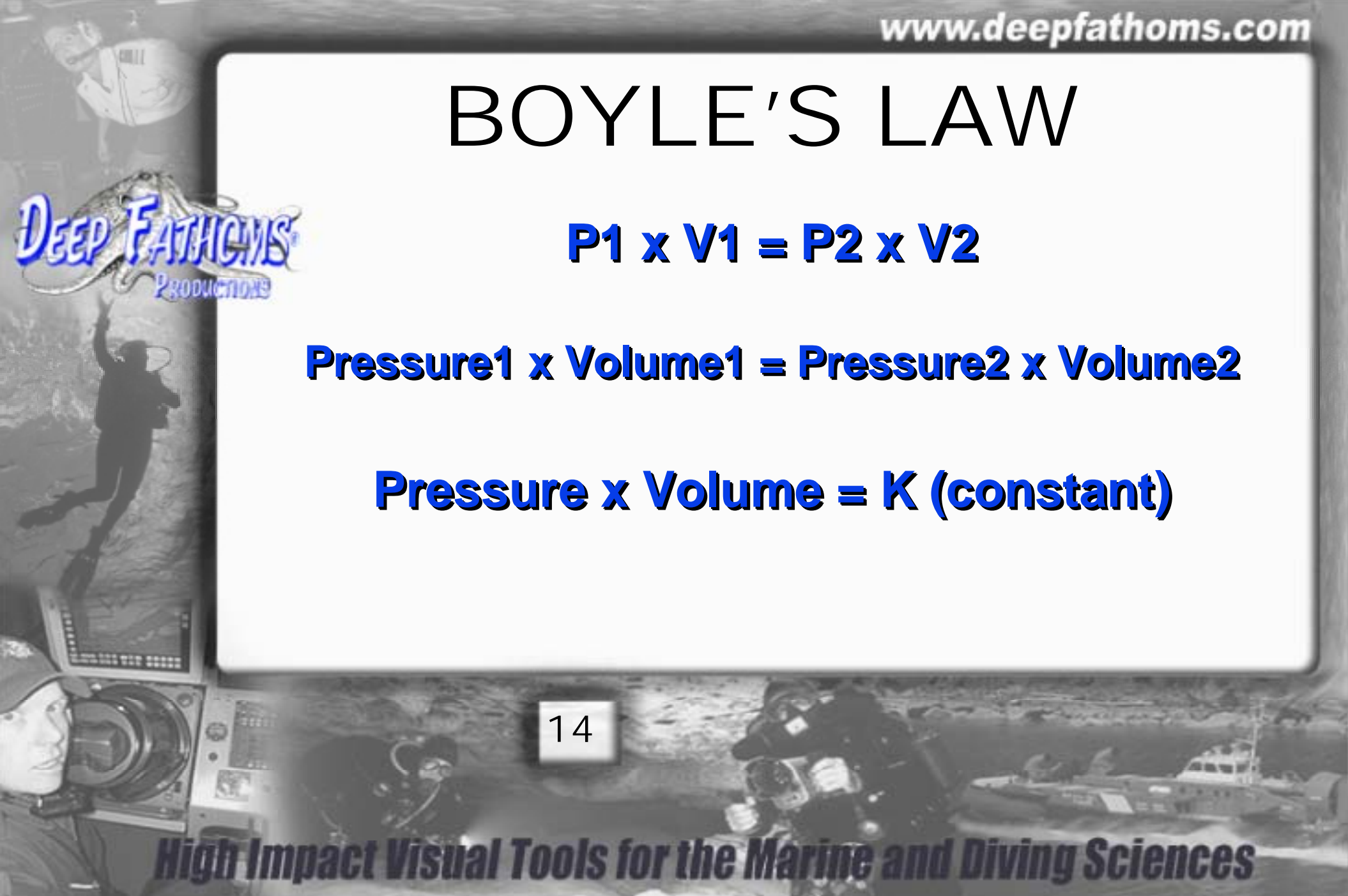


BOYLE'S LAW

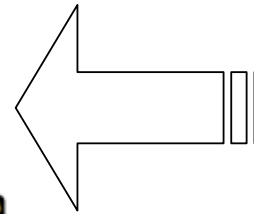
$$P_1 \times V_1 = P_2 \times V_2$$

$$\text{Pressure}_1 \times \text{Volume}_1 = \text{Pressure}_2 \times \text{Volume}_2$$

$$\text{Pressure} \times \text{Volume} = K \text{ (constant)}$$

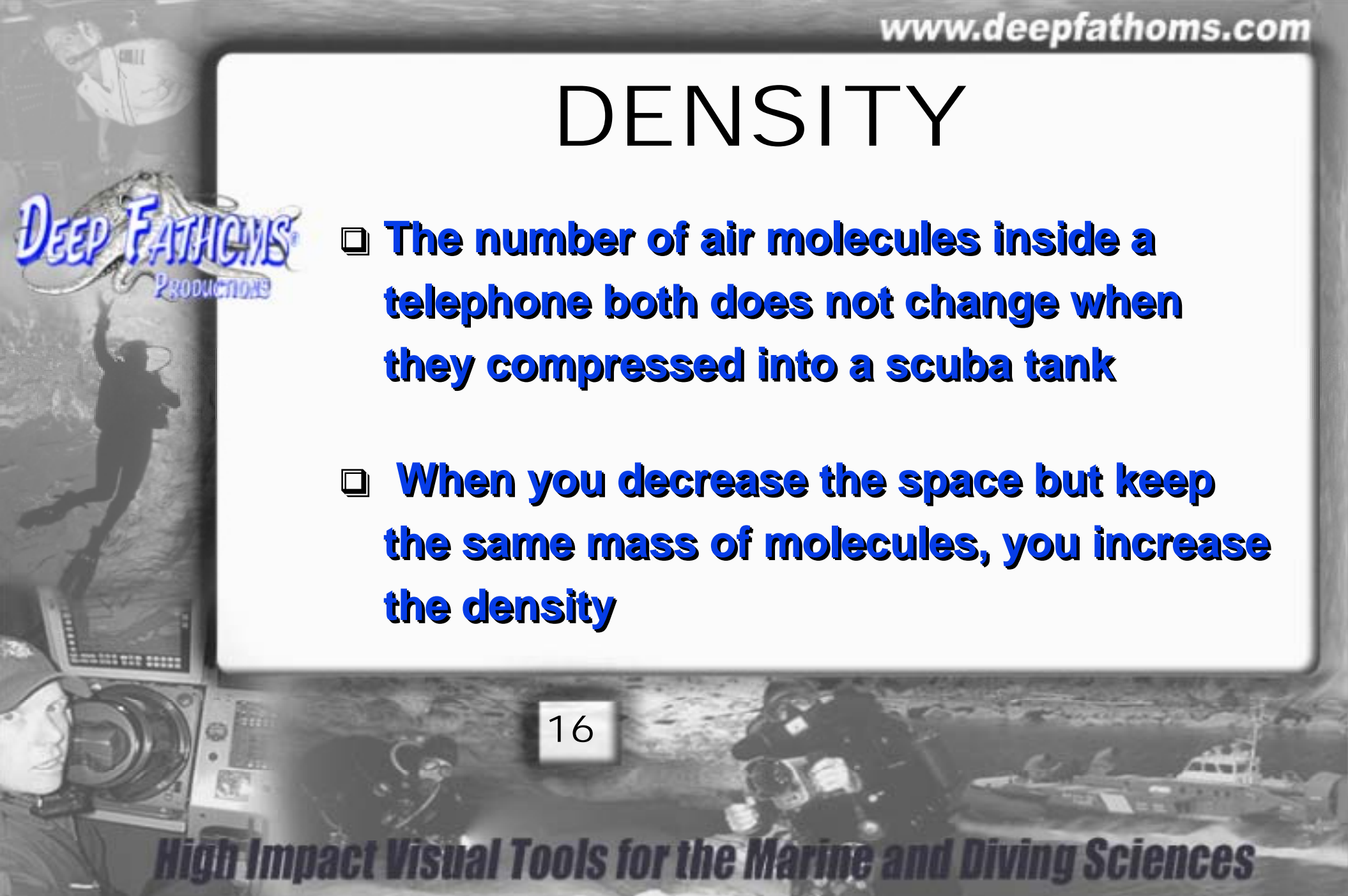


**A scuba tank
holds the same
amount of air that
is inside of a
telephone booth**



DENSITY

- ❑ **The number of air molecules inside a telephone both does not change when they compressed into a scuba tank**
- ❑ **When you decrease the space but keep the same mass of molecules, you increase the density**

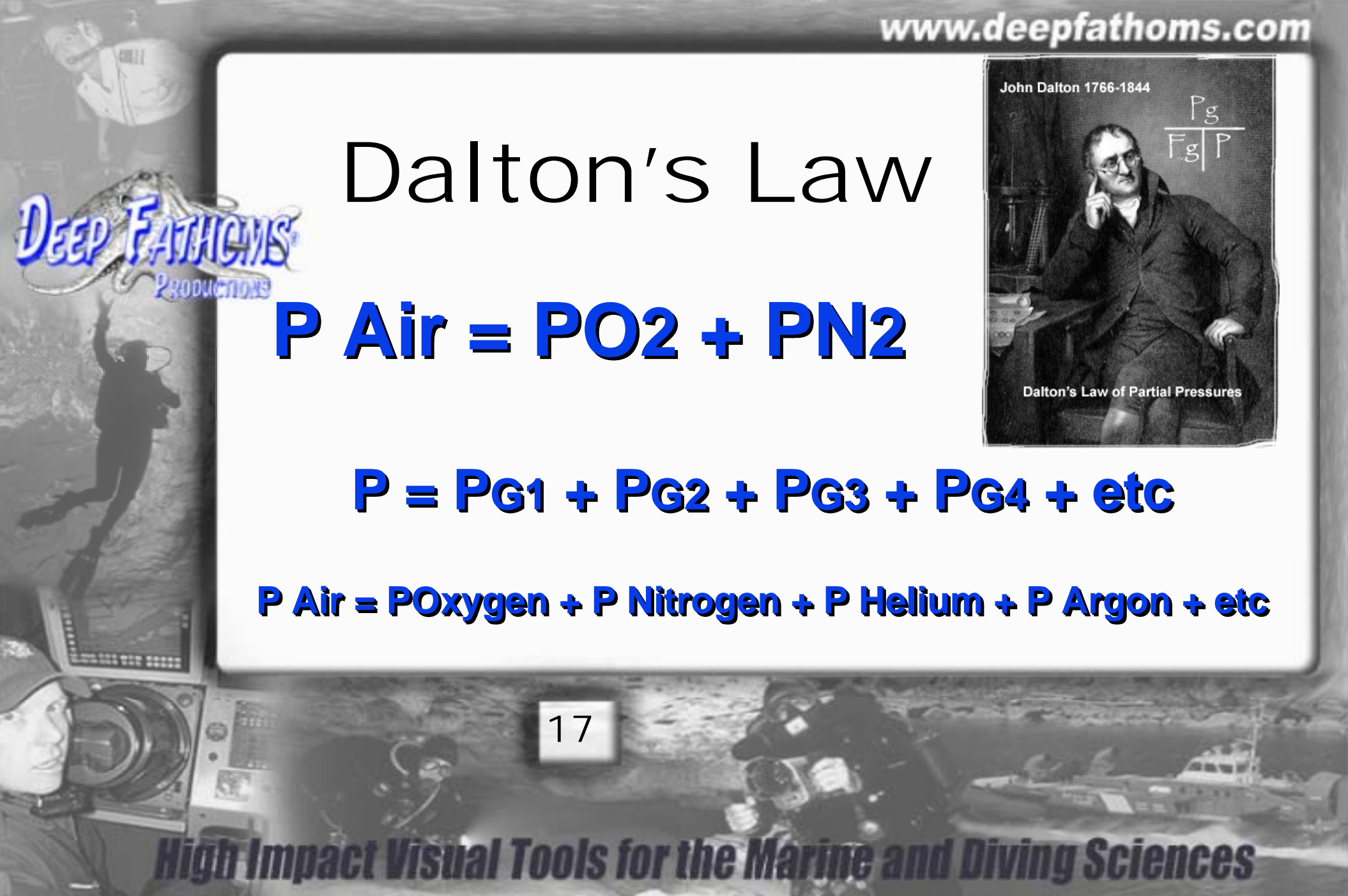
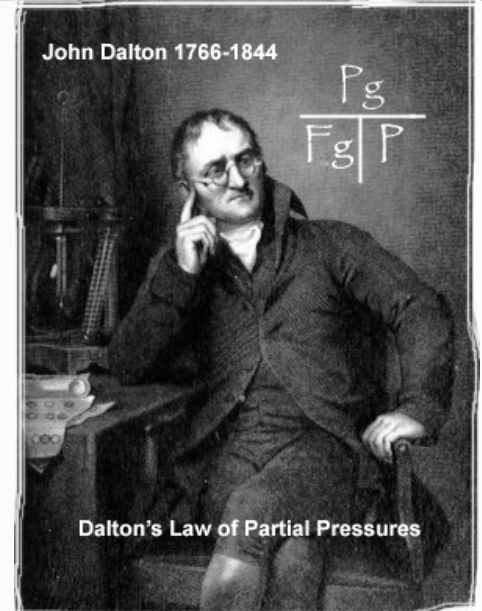


Dalton's Law

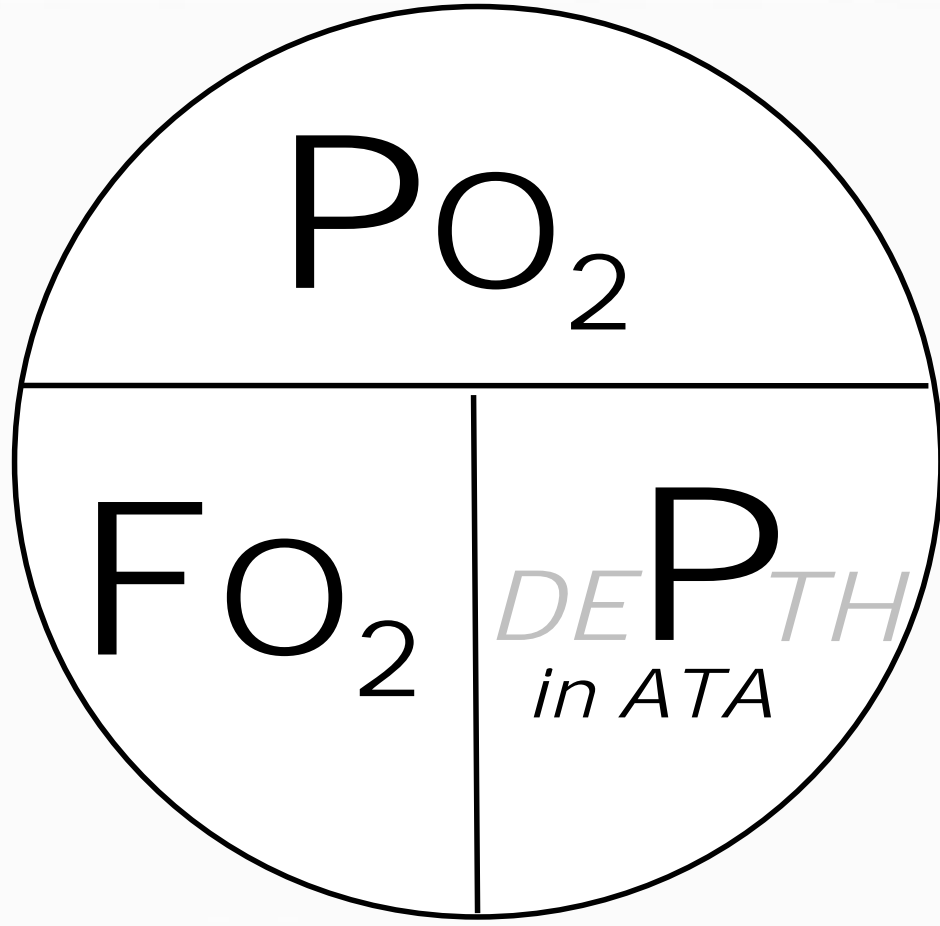
$$P_{\text{Air}} = P_{\text{O}_2} + P_{\text{N}_2}$$

$$P = P_{G1} + P_{G2} + P_{G3} + P_{G4} + \text{etc}$$

$$P_{\text{Air}} = P_{\text{Oxygen}} + P_{\text{Nitrogen}} + P_{\text{Helium}} + P_{\text{Argon}} + \text{etc}$$

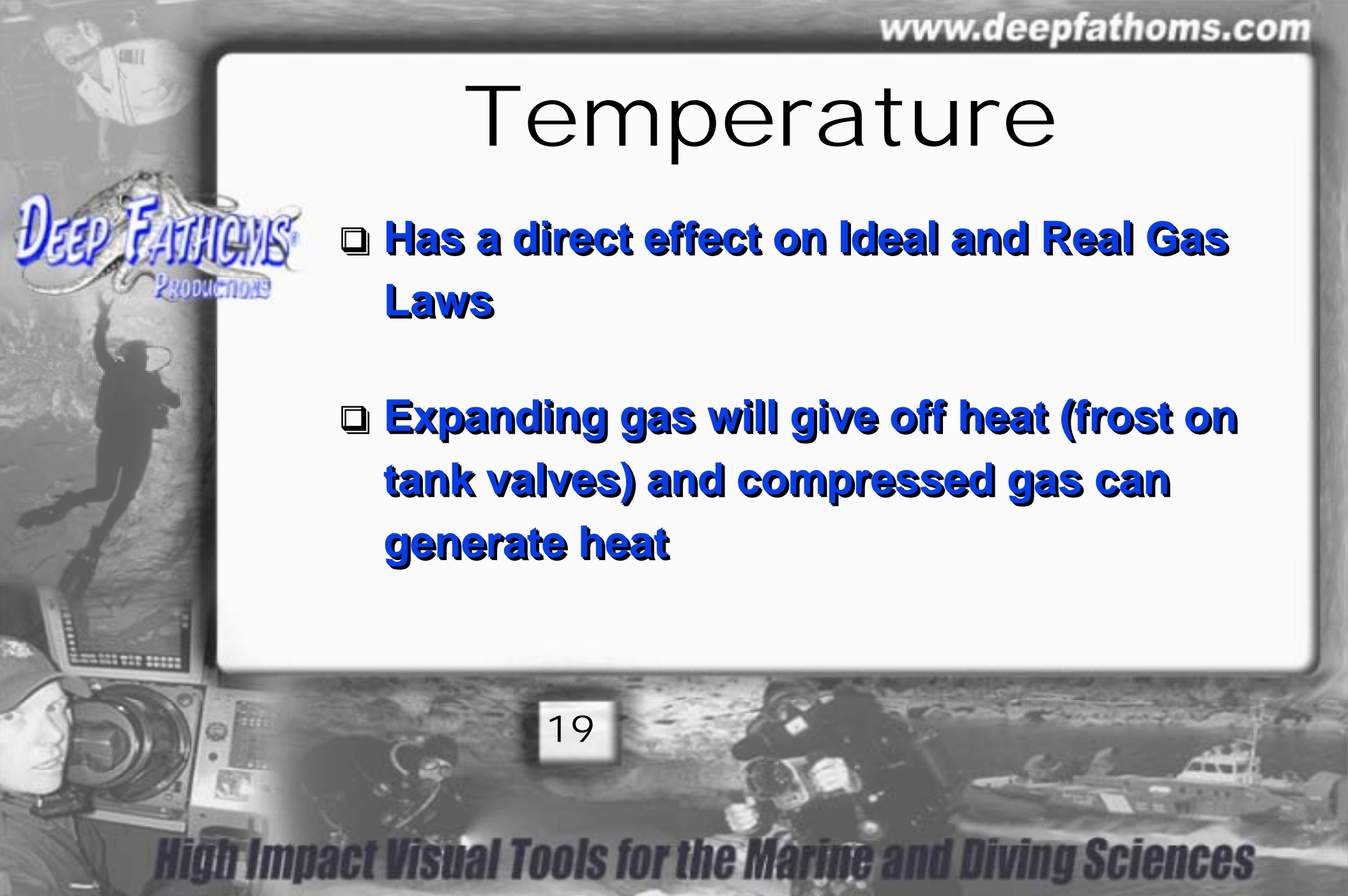


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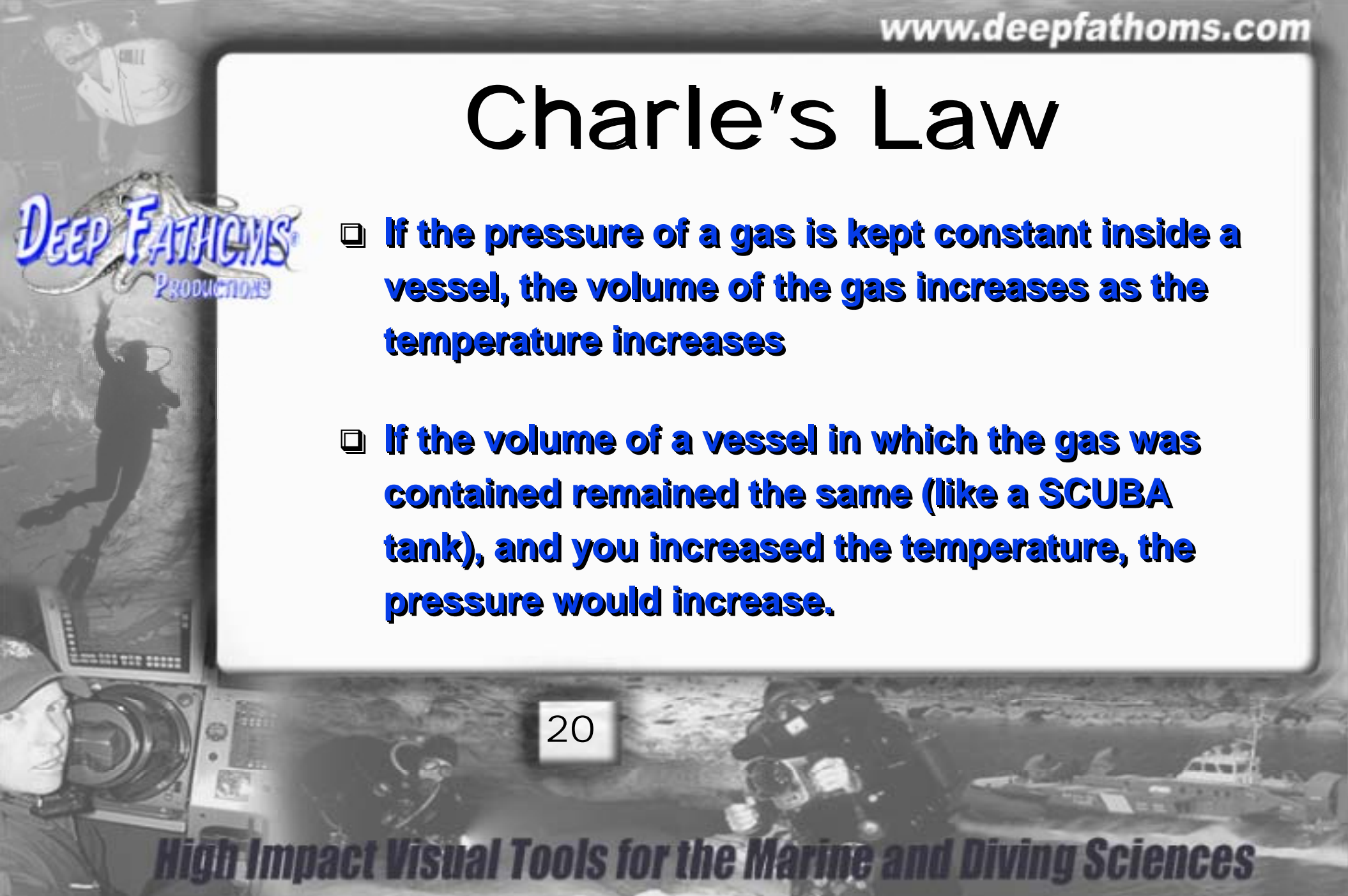
Temperature

- ❑ **Has a direct effect on Ideal and Real Gas Laws**
- ❑ **Expanding gas will give off heat (frost on tank valves) and compressed gas can generate heat**



Charles's Law

- ❑ **If the pressure of a gas is kept constant inside a vessel, the volume of the gas increases as the temperature increases**
- ❑ **If the volume of a vessel in which the gas was contained remained the same (like a SCUBA tank), and you increased the temperature, the pressure would increase.**



Final Message

- The physical properties of gases have immense effect on our ability to dive safely
- We need to understand them to in order to better understand all of the elements that effect a safe dive plan
- In order to respect and appreciate basic diving physiology we need to have a basic understanding of diving physics

Nadeau