Avionics Technology

B31353551

— *Altimeter*

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I. Altimeter

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（1）Some concepts

（2）Altitude from air measurement

（3）Errors correction

（3）Errors correction

- Correcting for nonstandard sea level pressure is relatively simple because it only requires knowledge of the pressure at only the sea level, while correcting for nonstandard temperature is more complex because it requires knowledge of the *mean* temperature.

(2) Correction for nonstandard temperature :

Suppose the actual sea level temperature T_0' is not equal to T_0, the indicated altitude can be compensated by applying the correction ΔH_{T0}.

（3）Errors correction

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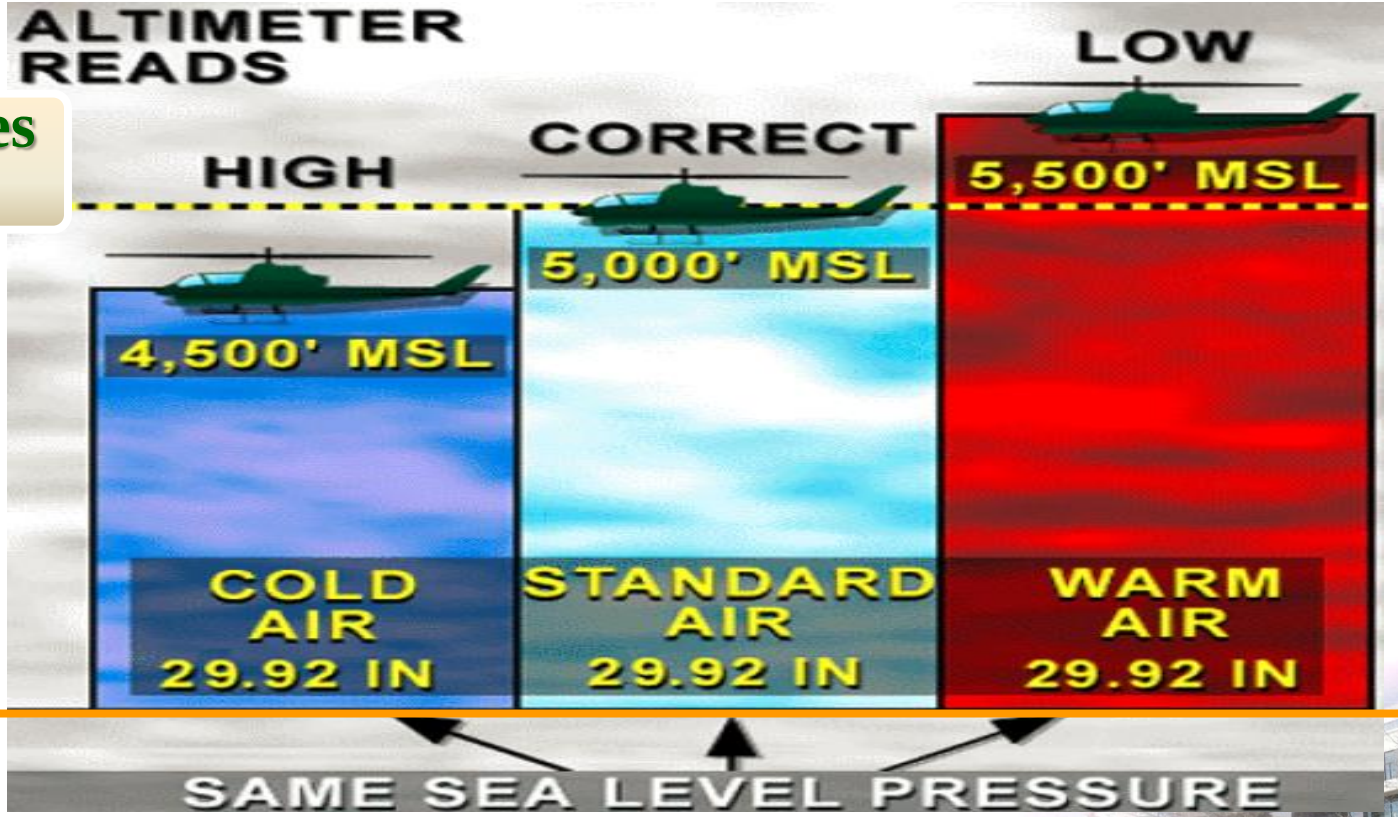
Indicated altitudes are the same



Indicated altitudes differ from *true altitudes— a example*

（3）Errors correction

- According to the *hydrostatic equilibrium* equation, we can derive:

$$\frac{dp}{p} = -\frac{g_n}{R_a T} dH \rightarrow H = \frac{R_a}{g_n} \overline{T} \ln \frac{p_0}{p_H}$$

The mean temperature between the sea level and the indicated *H*

- In the 'standard' atmosphere (SA), we have:

$$H_{SA} = \frac{R_a}{g_n} \overline{T}_{SA} \ln \frac{p_0}{p_H}$$

- Then, the relative error (E) between H_{SA} and H is defined as

$$E = \frac{H_{SA} - H}{H} = \frac{\overline{T}_{SA} - \overline{T}}{\overline{T}}$$

（3）Errors correction

$$\Delta H_{T_0} / H = \Delta T_0 / \overline{T}$$

$$\Delta H_{T_0} = H \frac{\Delta T_0}{\overline{T}}$$

The mean of *T* is represented with a simple *arithmetic mean* based on that the lapse rate is still assumed to constant

- $\Delta T_0 \rightarrow \Delta H_{T0}$:

$$\Delta H_{T_0} \approx H \frac{\Delta T_0}{T_0^{'} - 0.5\beta H} = H \frac{(T_0 - T_0^{'})}{T_0^{'} - 0.5\beta H}$$

- Correction: **Indicated $H - \Delta H_{T0}$**

（3）Errors correction

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- For aircraft approach and landing operations, *cold temperature* altimeter corrections are determined using reported temperature measurement combined with look-up cold temperature error table.

Cold temperature error table

Indicated altitudes → Height Above Airport in Feet

Surface Temp

Reported Temp °C	200	300	400	500	600	700	800	900	1000	1500	2000	3000	4000	5000
+10	10	10	10	10	20	20	20	20	20	30	40	60	80	90
0	20	20	30	30	40	40	50	50	60	90	120	170	230	280
-10	20	30	40	50	60	70	80	90	100	150	200	290	390	490
-20	30	50	60	70	90	100	120	130	140	210	280	420	570	710
-30	40	60	80	100	120	140	150	170	190	280	380	570	760	950
-40	50	80	100	120	150	170	190	220	240	360	480	720	970	1210
-50	60	90	120	150	180	210	240	270	300	450	590	890	1190	1500

（3）Errors correction

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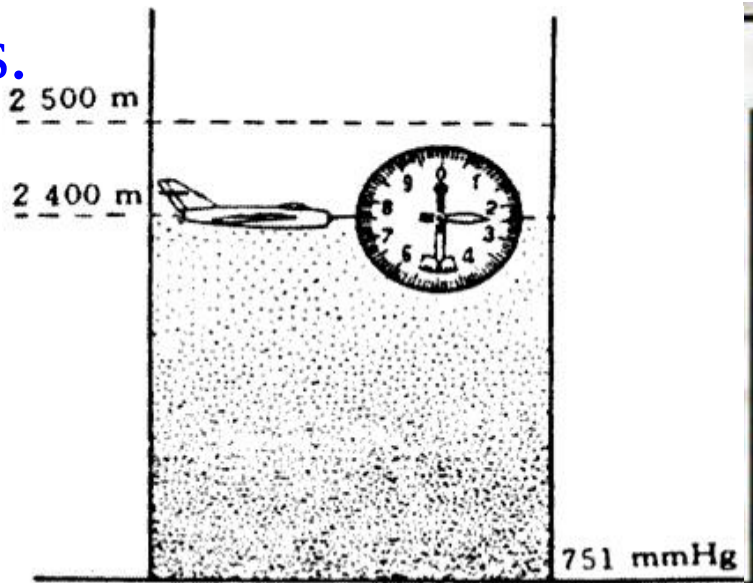
- If the air is colder than the ‘standard’ atmosphere or the actual sea level pressure is lower than the standard sea level pressure, the aircraft will be lower than the altimeter indicates.
- Under these conditions, a pilot should watch out below (e.g. a mountain top).



Indicated altitudes* higher than *true altitudes

（3）Errors correction

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- A pilot is required to obtain the *approximate true altitude* from the indicated (pressure) altitude for the aircraft's terrain and obstacles avoidance.
- While the information of *pressure altitude* is enough for ATC to coordinate and maintain safe vertical separation of aircrafts with each other.

ATC: Air Traffic Control

Vertical separation = Relative height

The end of *Altimeter*