Ascents from 300 ft (91.4m) Dives on Trimix 10/70

Comparison of V-Planner VPM-B to GAP RGBM and GF

•**At 300 ft, VPM-B decompressions are similar to RGBM, but much more aggressive than GF for long bottom times.**

Organization

•**NOTES and CONCLUSIONS**
    •**pages 2 – 4**

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Notations and Conventions

Profiles

•18 profiles of 300 ft on Trimix 10/70 back gas, with bottom times ranging from 10-180 min are modeled, with deco on 5-gases Trimix 10/70, 21/35, 35/25, Nitrox 50% and O_2.

•Total of 54 VPM-B models = 18-profiles x 3-conservatisms, with correlations to GAP RGBM and GF.

•All ascents at 33 ft/min. No breaks included from O_2 exposure. All descents on back gas at 100 ft/min.

Plots

•Gas mixtures denoted as percents in braces: {$\%O_2$, %He, $\%N_2$}

  •Trimix 10/70 is then: {10,70,20}

•Three types of plots are shown that correlate VPM-B to RGBM and GF:

  •RGBM and GF vs. VPM Total Ascent Times (pages: 10, 17, 24)

  •Overlaid stair-step profiles (pages: 6, 8,13,15,20,22)

  •RGBM, and GF Stop-times vs. VPM-B stop-times (pages: 7,9,14,16,21,23)

•Diagonal lines in plots are *NOT* fitted to points –they are just indications of 1:1 correlation to guide your eyes.

  •Points that lie above the diagonals denote longer GF and RGBM times, while points below the lines indicate longer VPM-B times.

V-Planner and GAP Software Settings

•Ascents were calculated by GAP RGBM v2.1.3 (Aug, 2003 Edition) and V-Planner (VPM-B) v3.22.

•VPM conservatisms are denoted: <u>N</u>ominal as VPM-B (N), Level 2 as VPM-B (2), and Level 4 as VPM-B (4).

•RGBM and GF run at nominal GAP conservatisms. VPM-B run at nominal (N), (2), and (4) conservatisms.

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Discussion of Correlation Plots for VPM-B to RGBM and GF Total Ascent Times (TATs)

VPM-B TATs Correlate Closely to RGBM, but not to GF

General Notes

•All data include time to 1st stop at ascent rate of 33 ft/min.

•TATs are closely related to comparative gradients for VPM-B, RGBM, and GF. Therefore, a longer TAT roughly implies a more conservative schedule.

RGBM vs. VPM-B (pages 10, 17, and 24)
•VPM-B(N) and RGBM TATs are 1:1 correlated for bottom times up-to 100 min.

•VPM-B(2) TATs are usually longer than RGBM.

•VPM-B(4) TATs are always longer than RGBM.

Gradient Factor vs. VPM-B (pages 10, 17, and 24)
•VPM-B TATs are much shorter than GF TATs, with VPM-B becoming comparatively more aggressive for longer bottom times.

•By implication, GF gradients are substantially reduced compared to RGBM and VPM-B gradients.

•VPM-B(4) TATs are close to GF for dives less than 20 min.

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Discussion of Correlation Plots of VPM-B to RGBM and GF Stop Times

General Notes

•The plots on pages 7, 9, 14, 16, 21, and 23 directly compare stop time vs. stop time for two different deco methods. They avoid the offsets that occur on the conventional stair-step depth vs. run-time plots of the same data, which are shown on pages 6, 8, 13, 15, 20, and 22.

•Data points are plots of the (x,y) pair: (VPM-B stop time, RGBM/GF stop time) for each decompression stop. Individual stop depths are not indicated, but generally, the longest stops correspond to the shallowest stops for each gas mixture. O_2 deco at 20 and 10 ft stops is indicated by green-colored points. Stops on back gas are shown as black-colored points. Other gases correspond to the legend colors. For the deepest stops, more than one point will often plot on top of another point.

RGBM vs. VPM-B (pages 7, 14, and 21)

•Because five different gases are used for decompression, the correlations in stop times across complex mix switches for VPM and RGBM indicate that the models are very similar.

•VPM-B(N) and (2) stops start shallower than RGBM, but over a wide range of bottom times, VPM-B and RGBM stop times are nearly 1:1 correlated (pages 7,14).

•VPM-B(4) shallow stops are longer than RGBM for all bottom times (page 21).

GF vs. VPM-B (pages 9, 16, and 23)

•VPM-B(N), (2), and (4) stops are much shorter than GF for long dives.

•VPM-B(N), (2), and (4) stops are similar to GF for bottom times shorter than 15 min.

Discussion of Plots of VPM-B Stop Times vs. Bottom Times

See pages 11, 18, 25

•For bottom times less than 90 mins, TATs and groups of stop times (e.g. times at 10+20 ft) are linearly correlated to dive times. This translates to simple rules that relate stop times to bottom times. We can use these relationships to specify analytically-based procedures for VPM-B deco-on-the-fly.

•For bottom times between 120 and 180 mins, time at 10 ft on O_2 remains approximately constant.

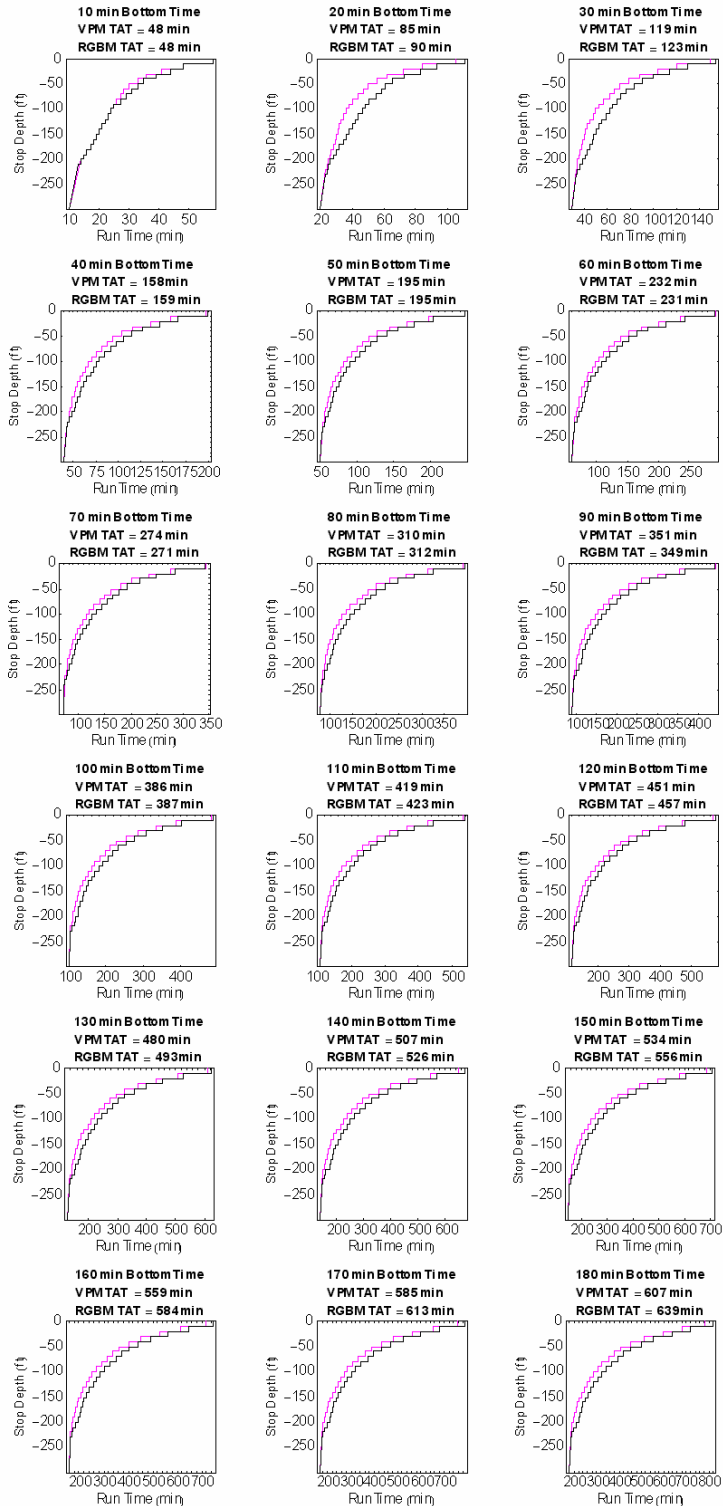Eric Maiken, 2004   Limited Distribution

SECTION 1

Ascents from Dives at 300 ft for 10 -180 min

VPM-B Conservatism Setting (N)

18 VPM-B profiles compared to RGBM and GF (pages 6-9)
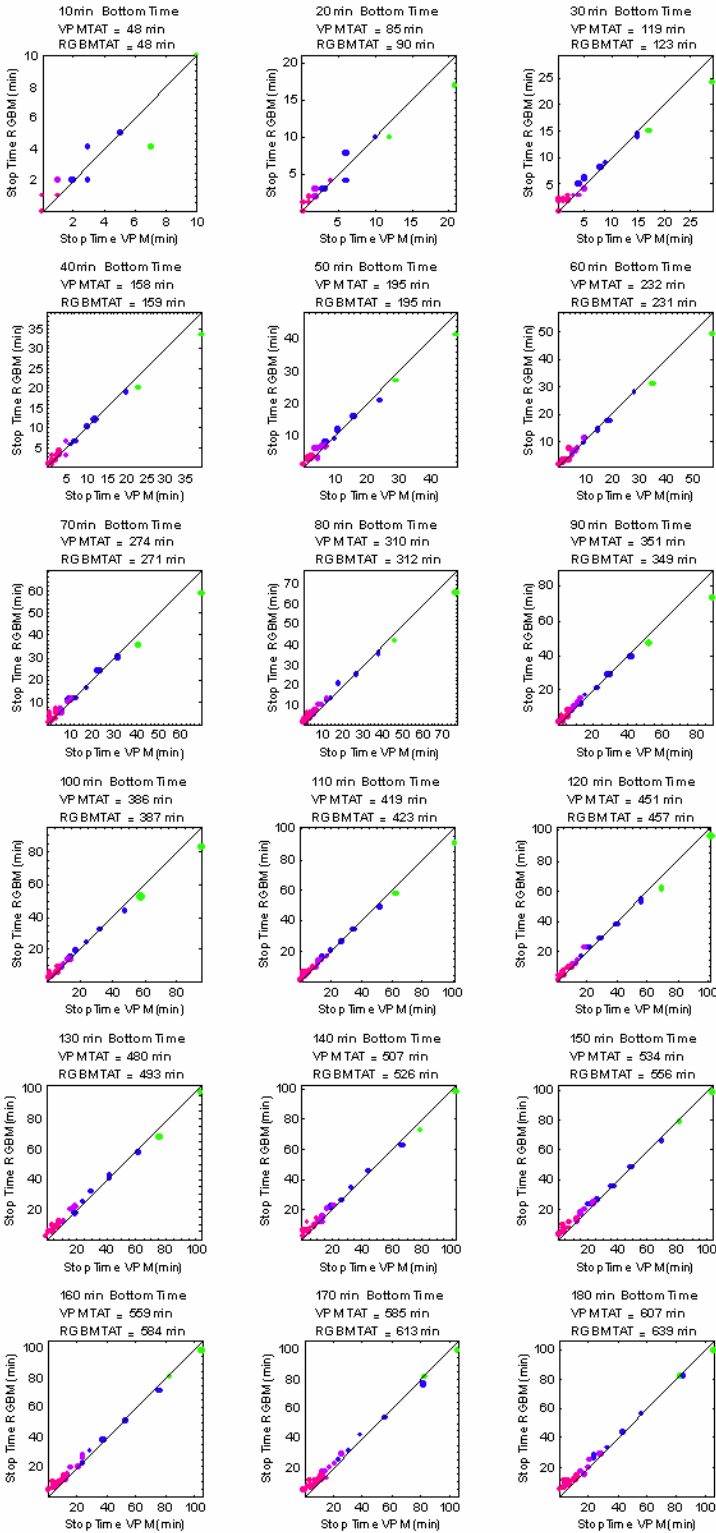**18 VPM-B ascents summarized (pages 10-11)**

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Comparison of RGBM and VPM−B (N) Ascents for Array of
300 ft Dives on Back Gas {O₂, He, N₂} = {10, 70, 20}
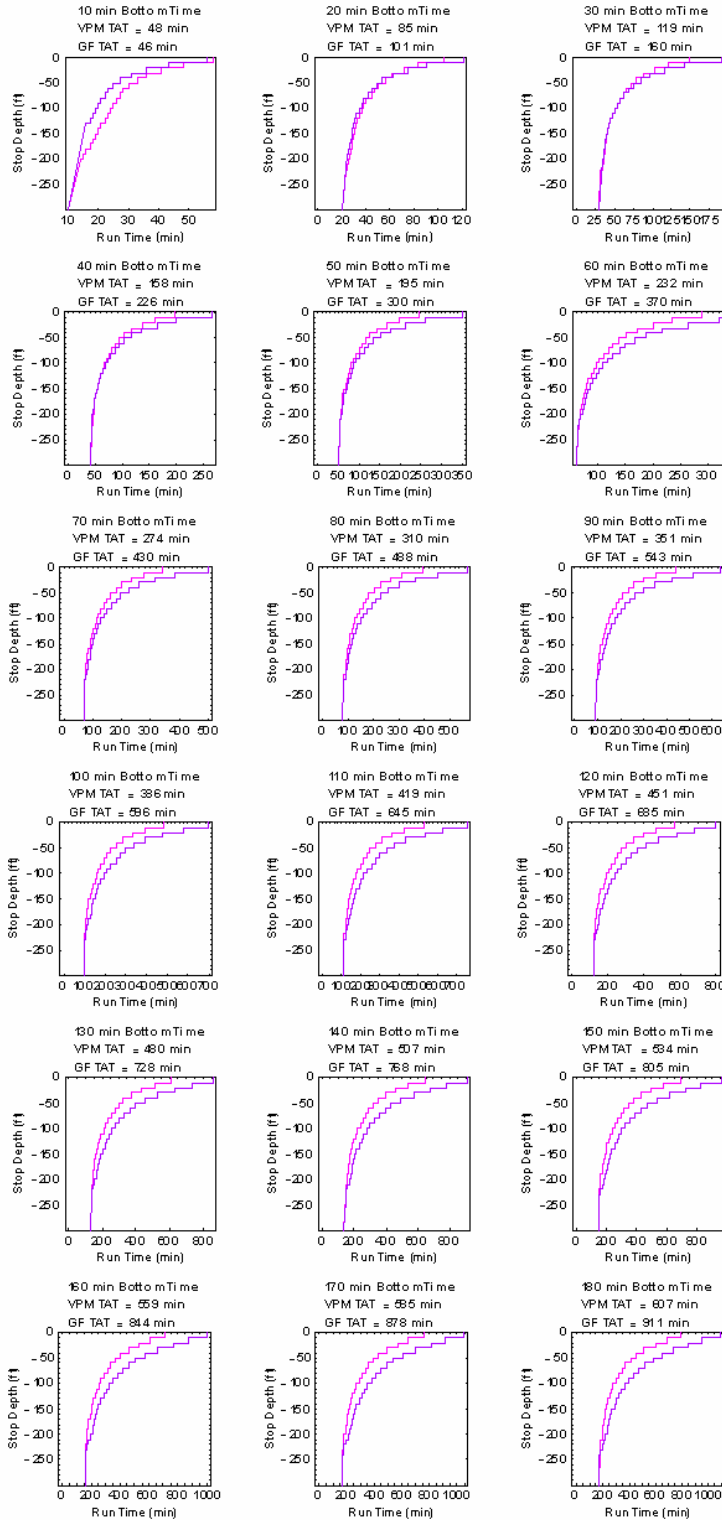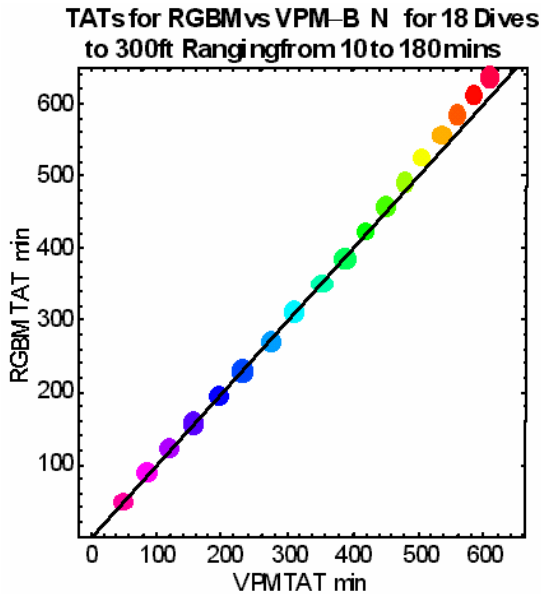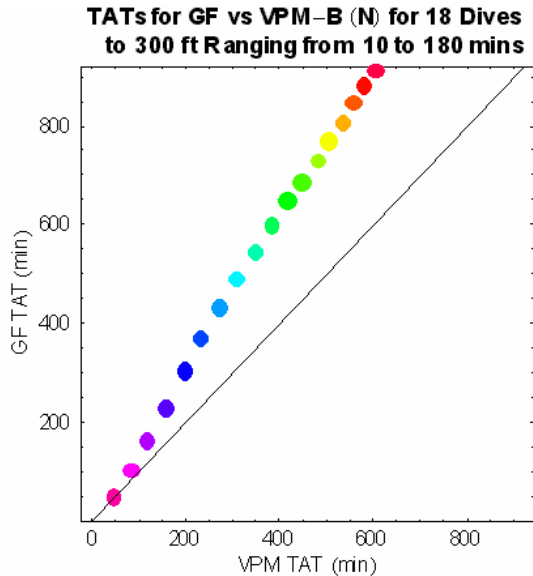## Deco on {10, 70, 20}, {21, 35, 44}, {35, 25, 40}, {50, 0, 50}, and {100, 0, 0}

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Correlation of RGBM to VPM–B (N) Stop Times for Array of
300 ft Dives on Back Gas $\{O_2, He, N_2\} = \{10, 70, 20\}$
Deco on $\{10, 70, 20\}$, $\{21, 35, 44\}$, $\{35, 25, 40\}$, $\{50, 0, 50\}$, and $\{100, 0, 0\}$

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LEGEND
Deco Gases
O_2, He, N_2
100, 0, 0
50, 0, 50
35, 25, 40
21, 35, 44

7

Comparison of GF and VPM−B (N) Ascents for Array of
300 ft Dives on Back Gas {O$_2$, He, N$_2$} = {10, 70, 20}
Deco on {10, 70, 20}, {21, 35, 44}, {35, 25, 40}, {50, 0, 50}, and {100, 0, 0}

LEGEND
Dive Profiles

VPM-B
GF

Correlation of GF to VPM–B (N) Stop Times for Array of
300 ft Dives on Back Gas [O₂, He, N₂] = [10, 70, 20]
Deco on [10, 70, 20], [21, 35, 44], [35, 25, 40], [50, 0, 50], and [100, 0, 0]

LEGEND
Deco Gases
O₂, He, N₂

100, 0, 0
50, 0, 50
35, 25, 40
21, 35, 44

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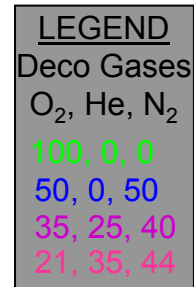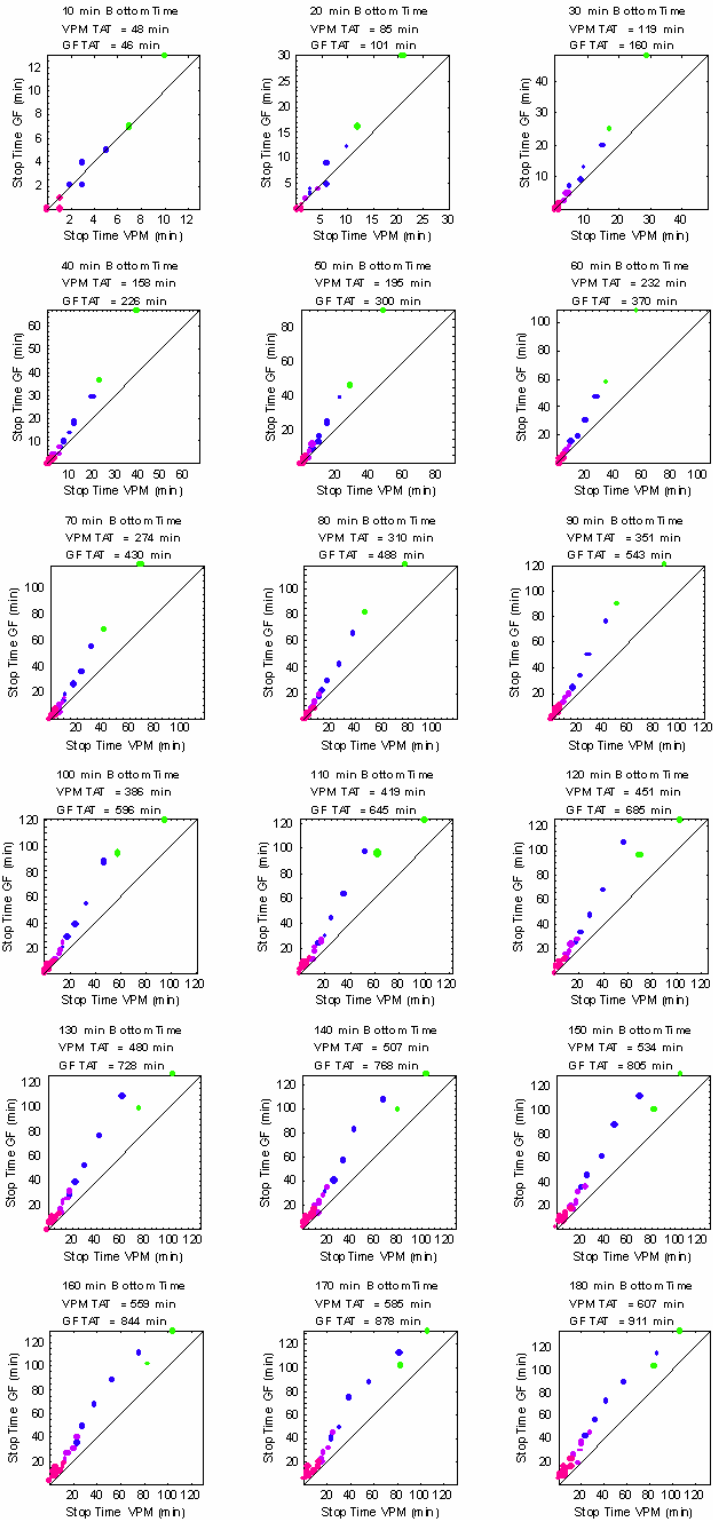
Correlation of RGBM and GF TATs to VPM-B(N) TATs for 300ft Dives

RGBM vs. VPM-B

TATs for RGBM vs VPM–B N for 18 Dives to 300ft Ranging from 10 to 180 mins

Gradient Factor vs. VPM-B

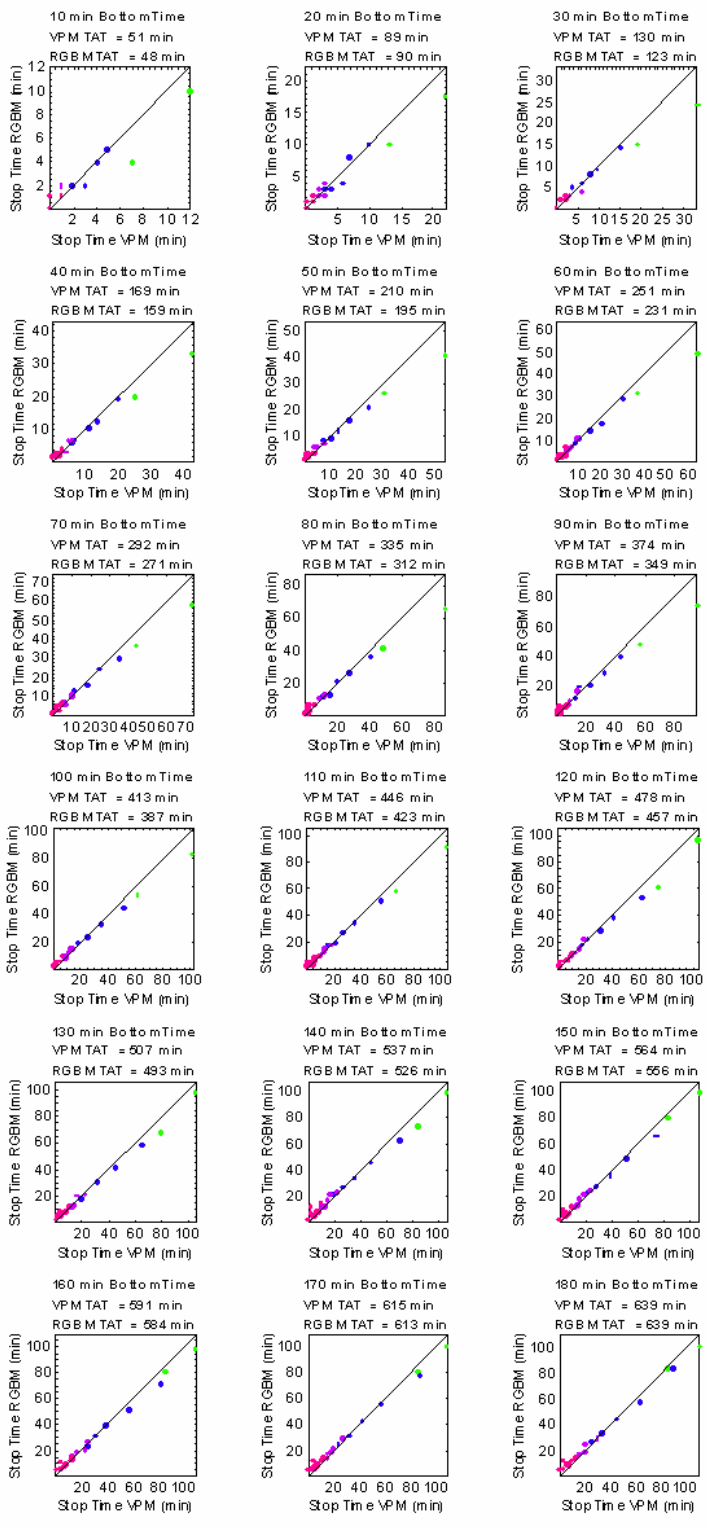TATs for GF vs VPM–B (N) for 18 Dives to 300 ft Ranging from 10 to 180 mins

Legend

Dive Time
10 min

180 min

Eric Maiken, 2004   Limited Distribution

Stop Times vs. Bottom Times
VPM-B Conservatism (N)

5 Deco Gases: 3mix 10/70,3mix 21/35, 3mix 35/25, Nx50/50, O$_2$

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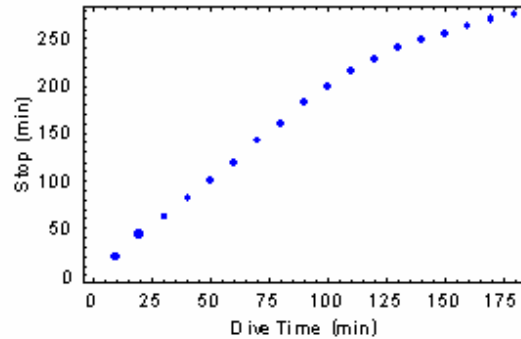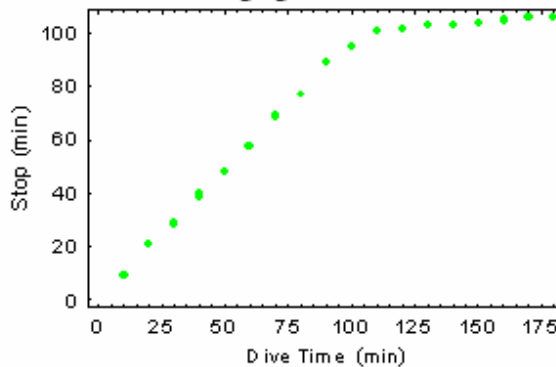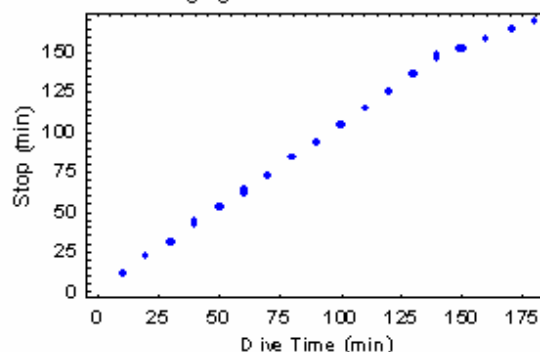
SECTION 2

Ascents from Dives at 300 ft for 10 -180 min

VPM-B Conservatism Setting (2)

18 VPM-B profiles compared to RGBM and GF (pages 13-16)
**18 VPM-B ascents summarized (pages 17-18)**

Comparison of RGBM and VPM-B (2) Ascents for Array of
300 ft Dives on Back Gas $\{O_2, He, N_2\} = \{10, 70, 20\}$
Deco on $\{10, 70, 20\}$, $\{21, 35, 44\}$, $\{35, 25, 40\}$, $\{50, 0, 50\}$, and $\{100, 0, 0\}$
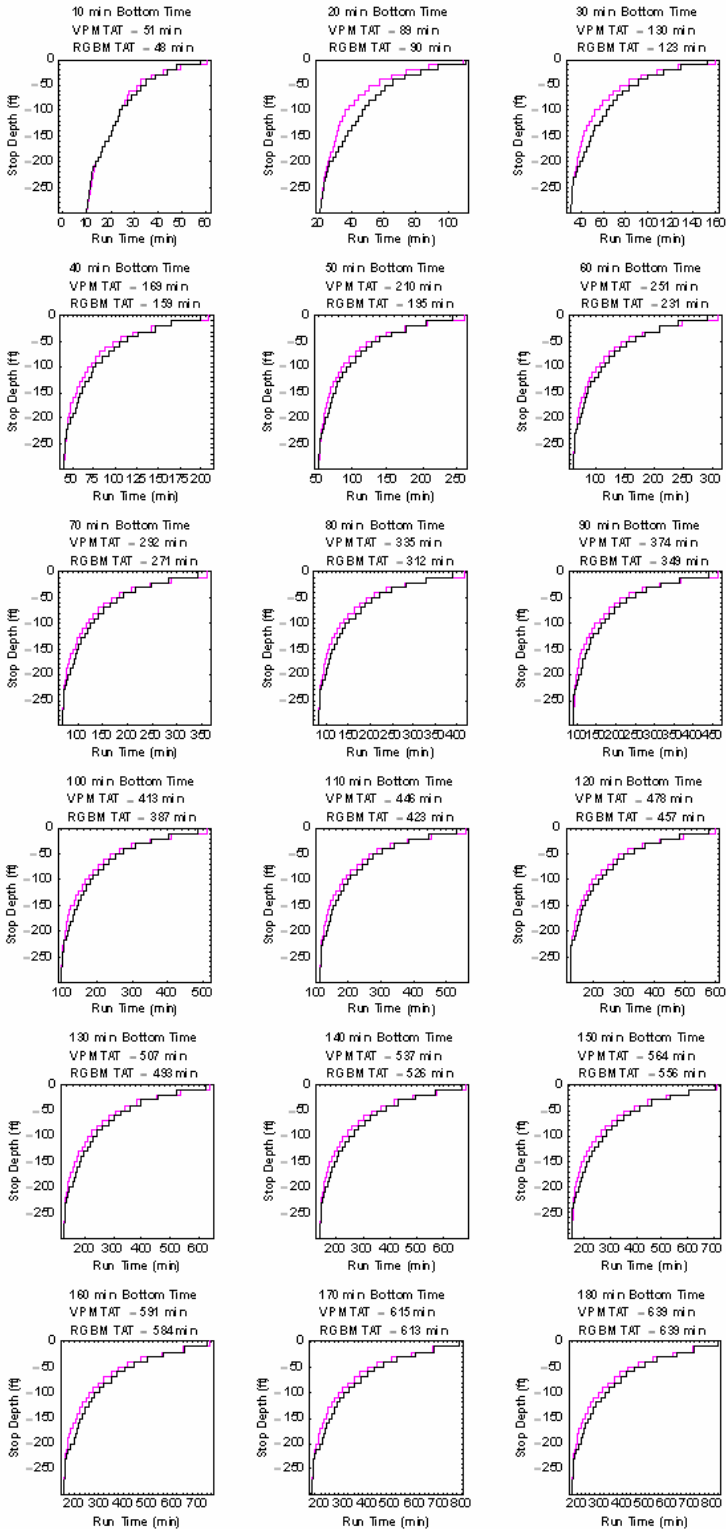
LEGEND
Dive Profiles

VPM-B
RGBM

Correlation of RGBM to VPM-B (2) Stop Times for Array of
300 ft Dives on Back Gas {O$_2$, He, N$_2$} = {10, 70, 20}
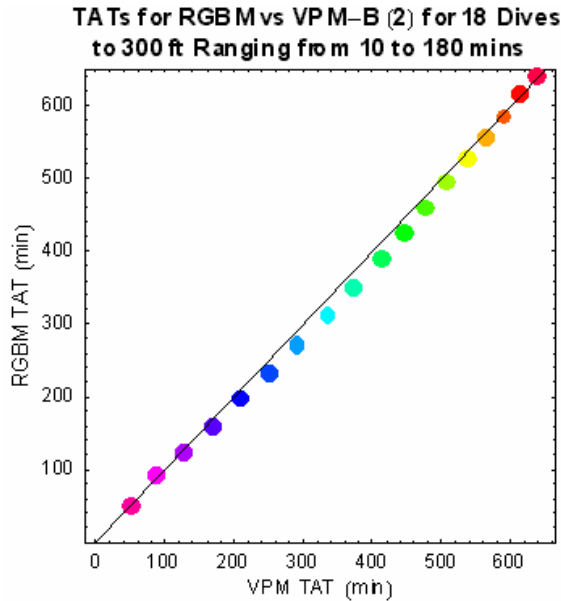### Deco on {10, 70, 20}, {21, 35, 44}, {35, 25, 40}, {50, 0, 50}, and {100, 0, 0}
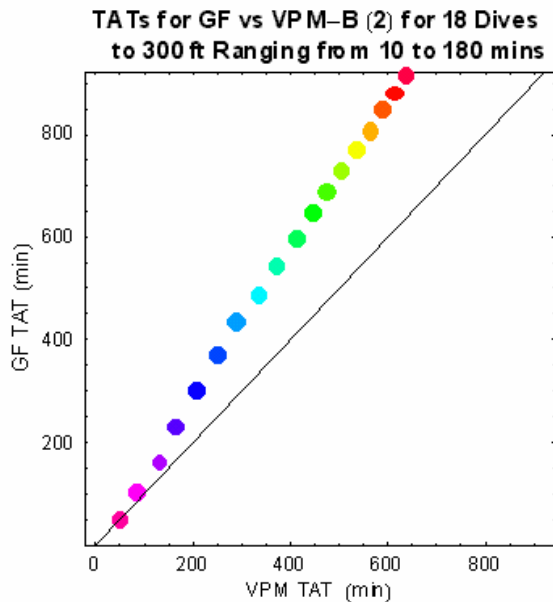

LEGEND
Deco Gases
O$_2$, He, N$_2$
100, 0, 0
50, 0, 50
35, 25, 40
21, 35, 44

Eric Maiken, 2004   Limited Distribution

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Comparison of GF and VPM-B (2) Ascents for Array of
300 ft Dives on Back Gas {O₂, He, N₂} = {10, 70, 20}
Deco on {10, 70, 20}, {21, 35, 44}, {35, 25, 40}, {50, 0, 50}, and {100, 0, 0}

Eric Maiken, 2004   Limited Distribution
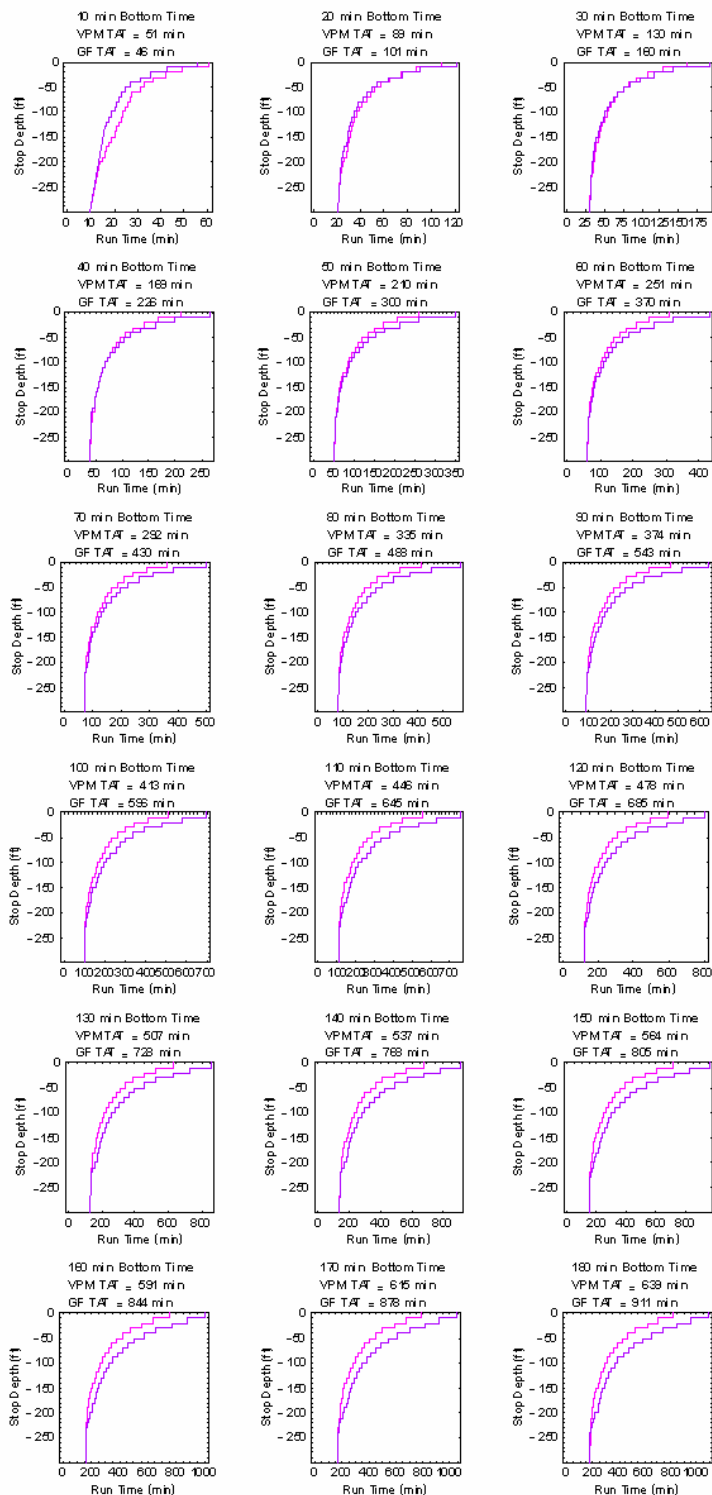
LEGEND
Dive Profiles

VPM-B
GF

Correlation of GF to VPM-B (2) Stop Times for Array of
300 ft Dives on Back Gas {O₂, He, N₂} = {10, 70, 20}
Deco on {10, 70, 20}, {21, 35, 44}, {35, 25, 40}, {50, 0, 50}, and {100, 0, 0}

LEGEND
Deco Gases
O₂, He, N₂

100, 0, 0
50, 0, 50
35, 25, 40
21, 35, 44

Eric Maiken, 2004   Limited Distribution

16
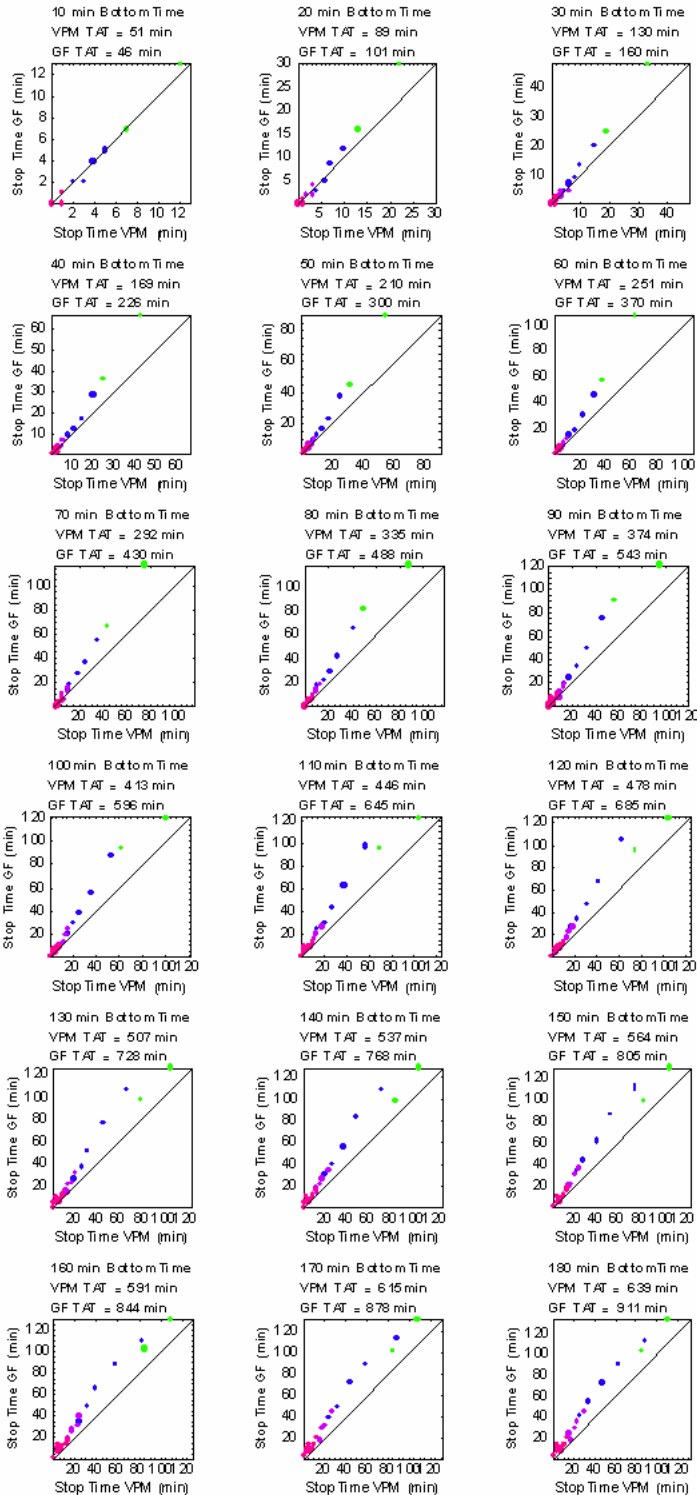
Correlation of RGBM and GF TATs to VPM-B(2) TATs for 300ft Dives
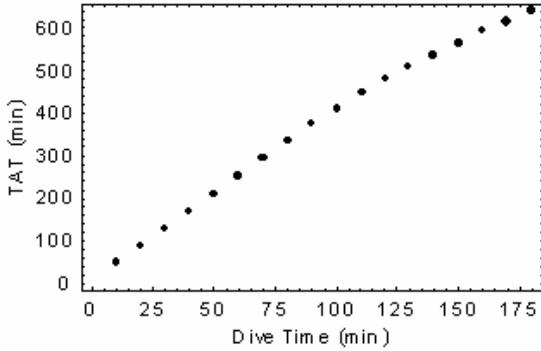
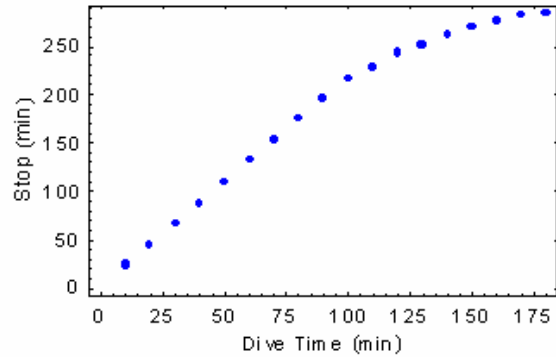**RGBM vs. VPM-B**

Gradient Factor vs. VPM-B

Eric Maiken, 2004   Limited Distribution
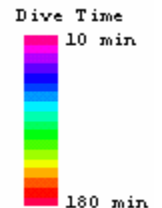
Stop Times vs. Bottom Times VPM-B Conservatism (2)

5 Deco Gases: 3mix 10/70, 3mix 21/35, 3mix 35/25, Nx50/50, O_2

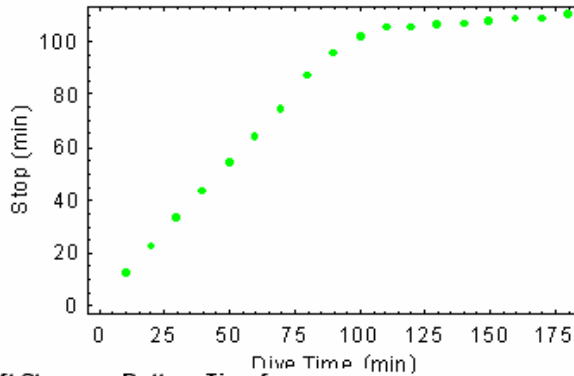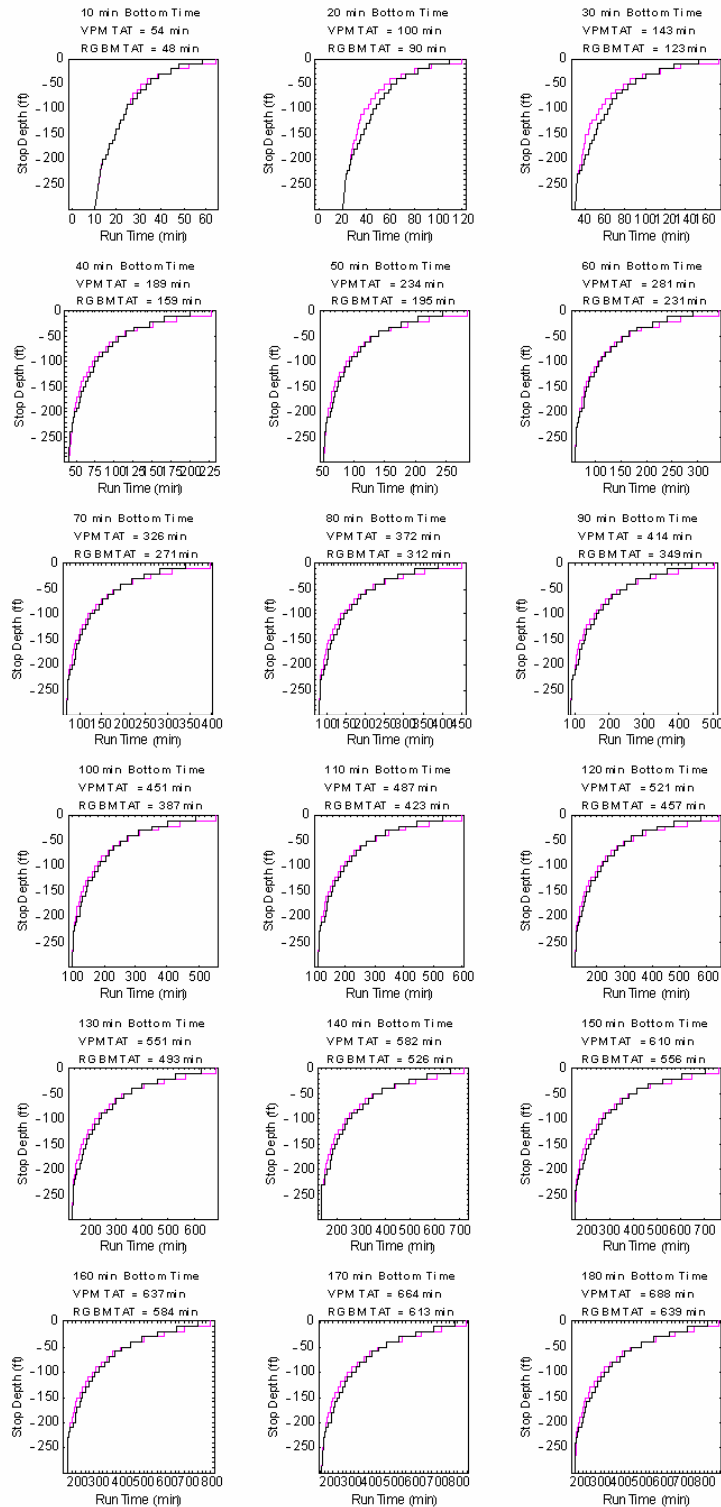Eric Maiken, 2004   Limited Distribution
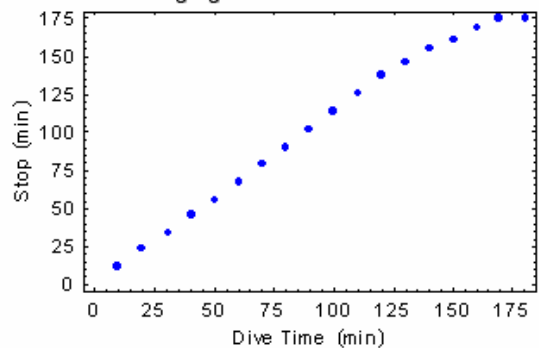
SECTION 3

Ascents from Dives at 300 ft for 10 -180 min

VPM-B Conservatism Setting (3)

18 VPM-B profiles compared to RGBM and GF (pages 20-23)
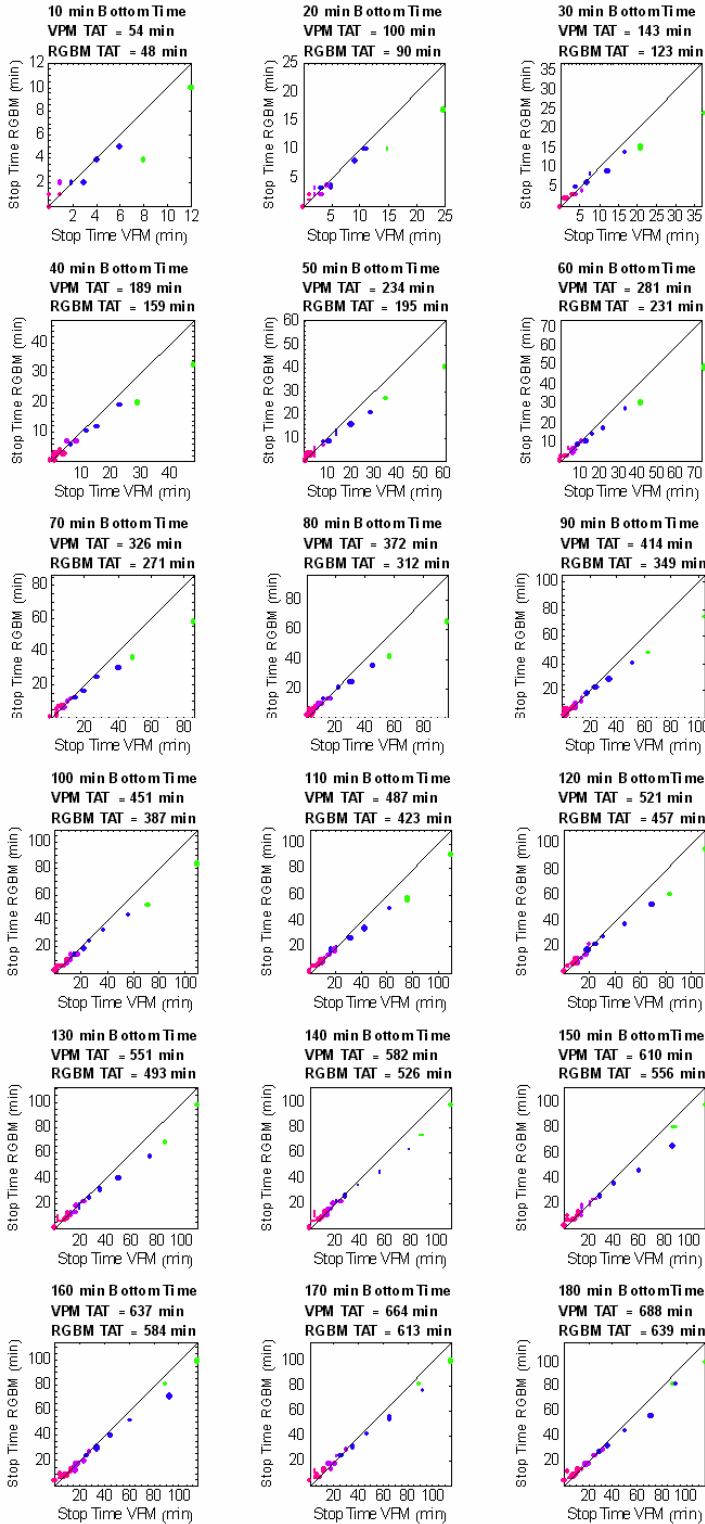**18 VPM-B ascents summarized (pages 24-25)**

Limited Distribution

Comparison of RGBM and VPM−B (4) Ascents for Array of
300 ft Dives on Back Gas $\{O_2, He, N_2\} = \{10, 70, 20\}$
Deco on $\{10, 70, 20\}$, $\{21, 35, 44\}$, $\{35, 25, 40\}$, $\{50, 0, 50\}$, and $\{100, 0, 0\}$

Eric Maiken, 2004   Limited Distribution
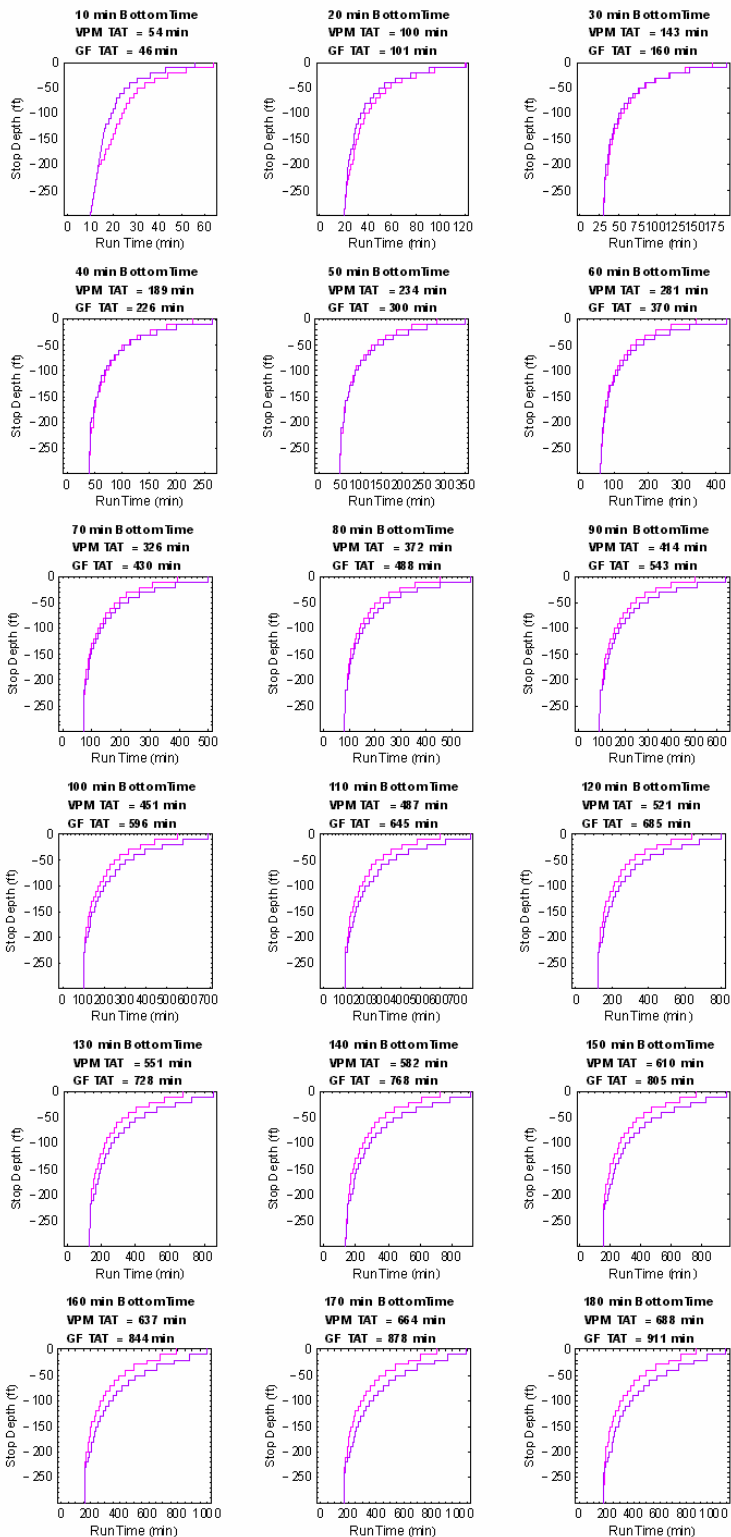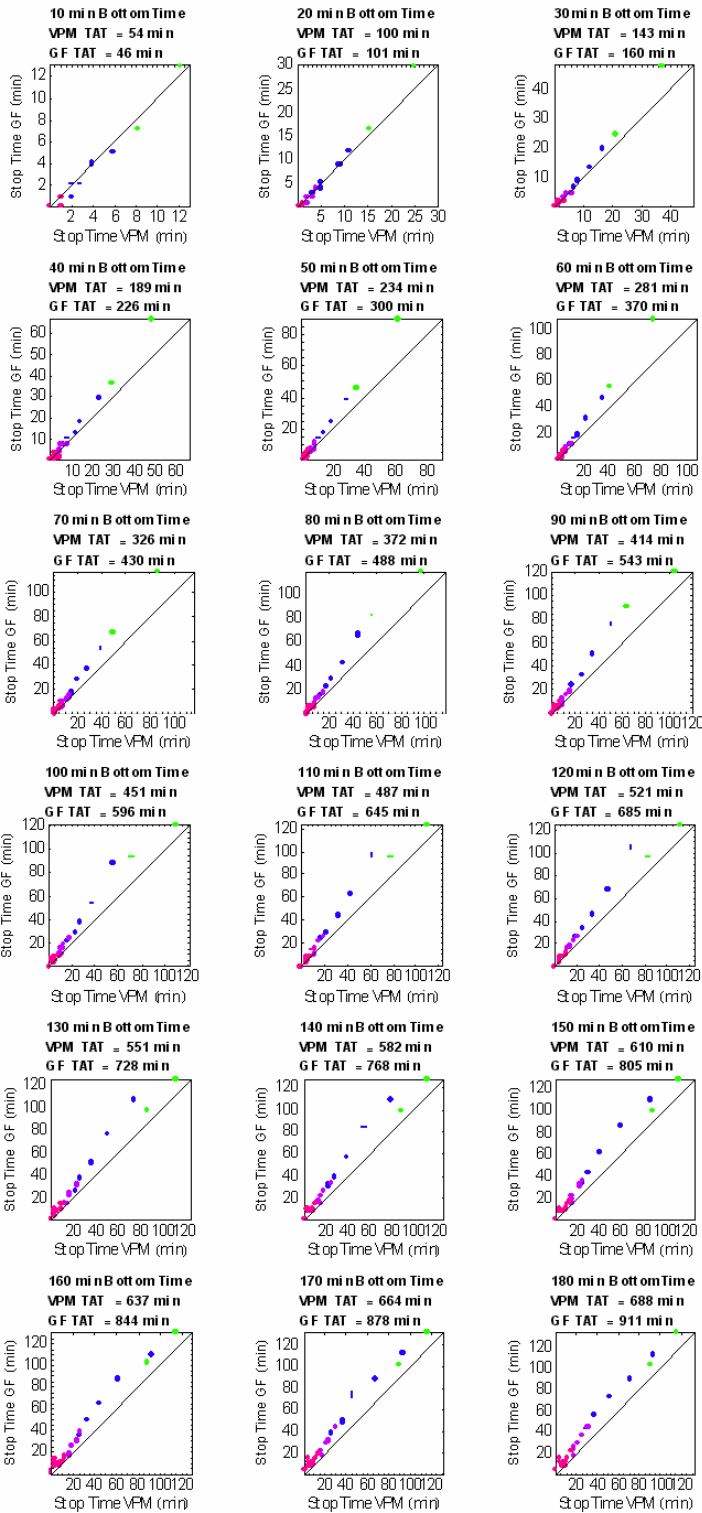
Correlation of RGBM to VPM−B (4) Stop Times for Array of
300 ft Dives on Back Gas {O₂, He, N₂} = {10, 70, 20}
Deco on {10, 70, 20}, {21, 35, 44}, {35, 25, 40}, {50, 0, 50}, and {100, 0, 0}

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Comparison of GF and VPM–B (4) Ascents for Array of
300 ft Dives on Back Gas $\{O_2, He, N_2\} = \{10, 70, 20\}$
Deco on $\{10, 70, 20\}$, $\{21, 35, 44\}$, $\{35, 25, 40\}$, $\{50, 0, 50\}$, and $\{100, 0, 0\}$

LEGEND
Dive Profiles

VPM-B
GF

Correlation of GF to VPM-B (4) Stop Times for Array of
300 ft Dives on Back Gas $\{O_2, He, N_2\} = \{10, 70, 20\}$
Deco on $\{10, 70, 20\}$, $\{21, 35, 44\}$, $\{35, 25, 40\}$, $\{50, 0, 50\}$, and $\{100, 0, 0\}$

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Correlation of RGBM and GF TATs to VPM-B(4) TATs for 300ft Dives

RGBM vs. VPM-B

TATs for RGBM vs VPM-B (4) for 18 Dives to 300 ft Ranging from 10 to 180 mins

Gradient Factor vs. VPM-B

TATs for GF vs VPM-B (4) for 18 Dives to 300 ft Ranging from 10 to 180 mins

Legend

Dive Time
10 min

180 min

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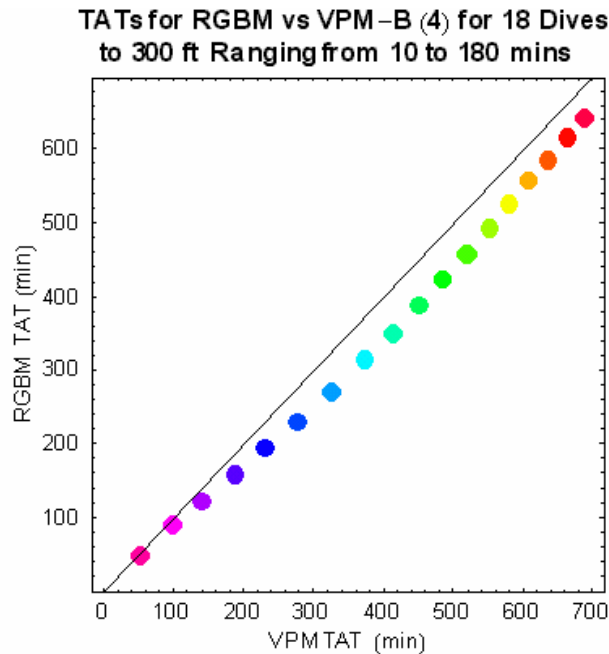
Stop Times vs. Bottom Times
VPM-B Conservatism (4)

5 Deco Gases: 3mix 10/70,3mix 21/35, 3mix 35/25, Nx50/50, O$_2$

Eric Maiken, 2004   Limited Distribution