

Squadron Leader
Jonny Hynes

What is MOD pilot experience
of the High Gz Training
Facility and are there factors
that can predict it?

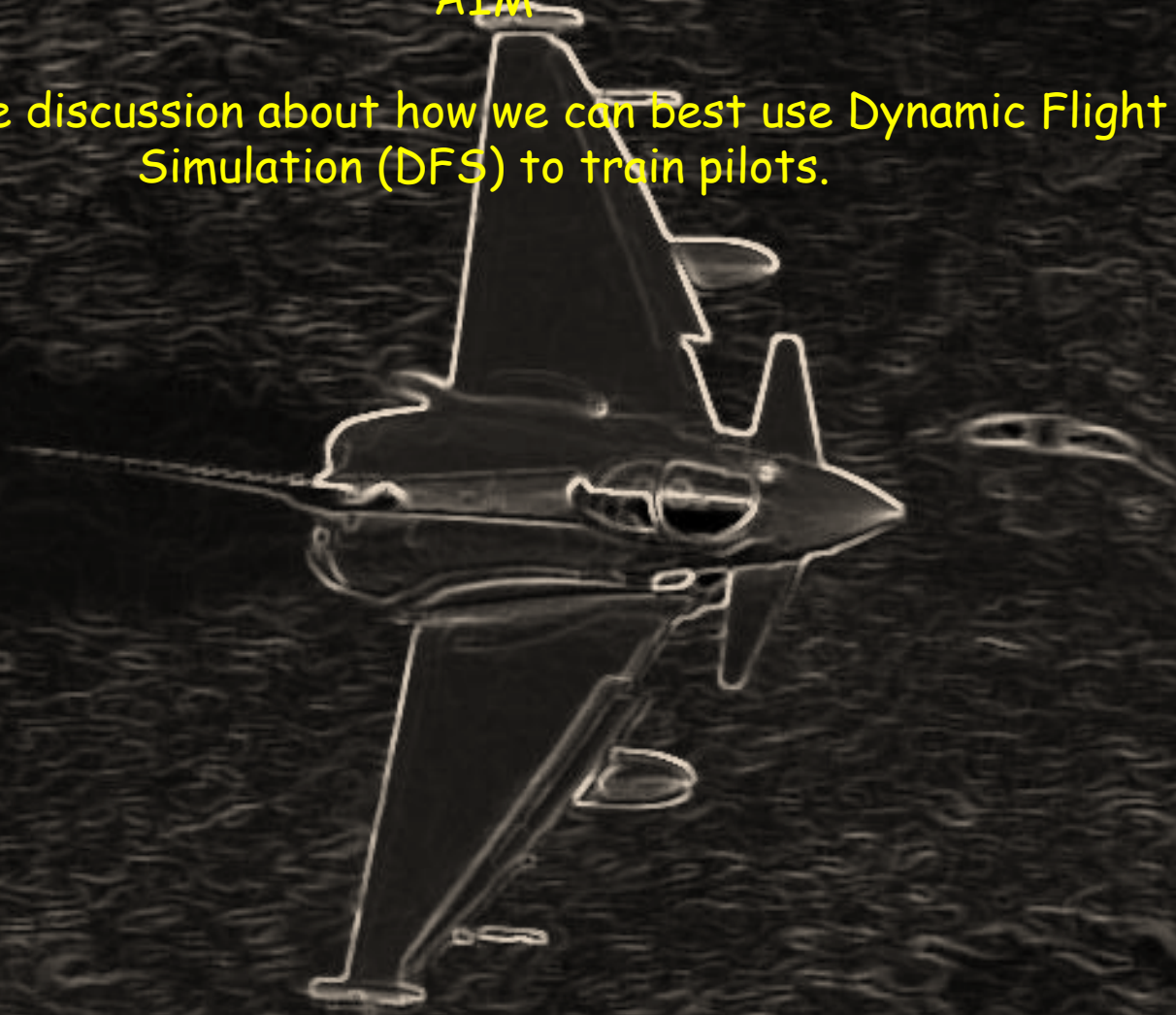
SCOPE

- Background
- Methodology
- Results
- Conclusions
- So What?
- Further work?
- 20 mins
- Questions



AIM

To create discussion about how we can best use Dynamic Flight Simulation (DFS) to train pilots.



CAVEAT

Personal thoughts not RAF Doctrine



BACKGROUND



What did we have?



What did we have?



What do we have?



What do we have?



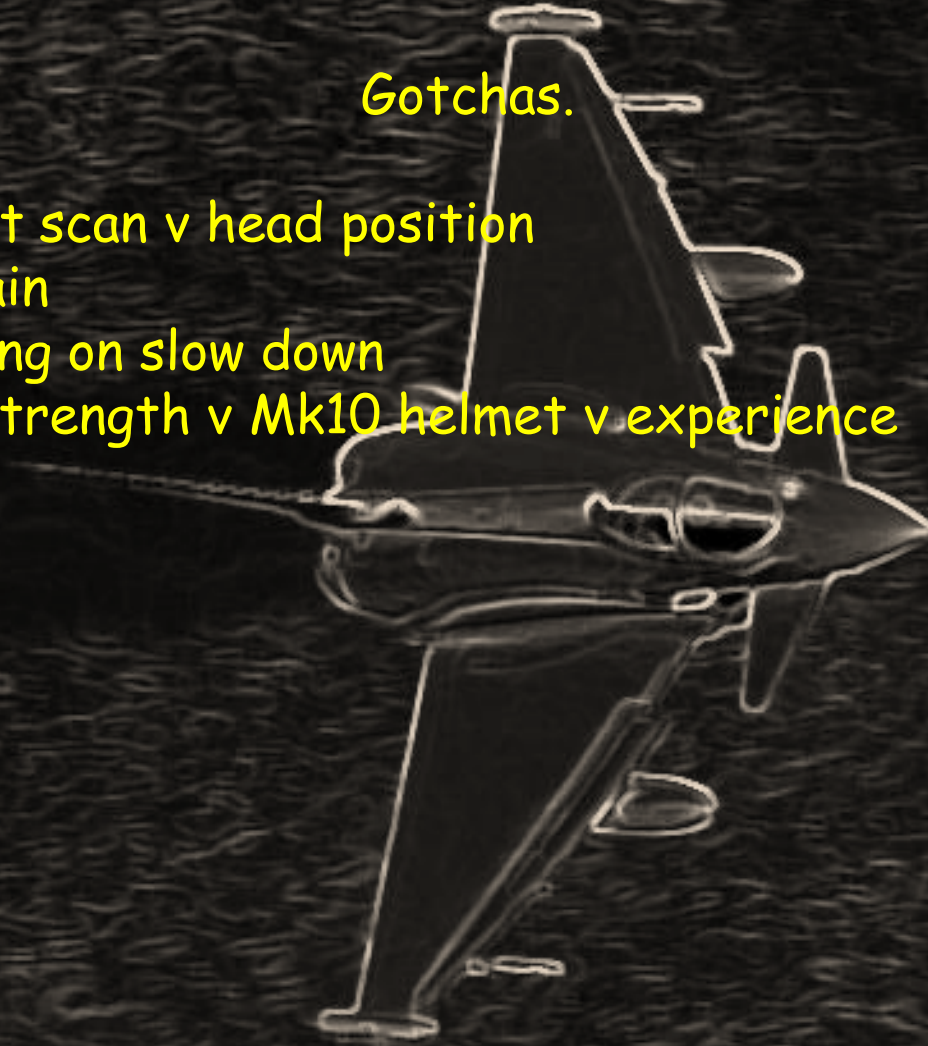
What can it do?

- 3 different cockpits F35/Typhoon/Hawk
- Open loop and closed loop control
- Accurate terrain mapping
- Combat manoeuvres/merge entry
- Push/pull effect
- Make you feel sick



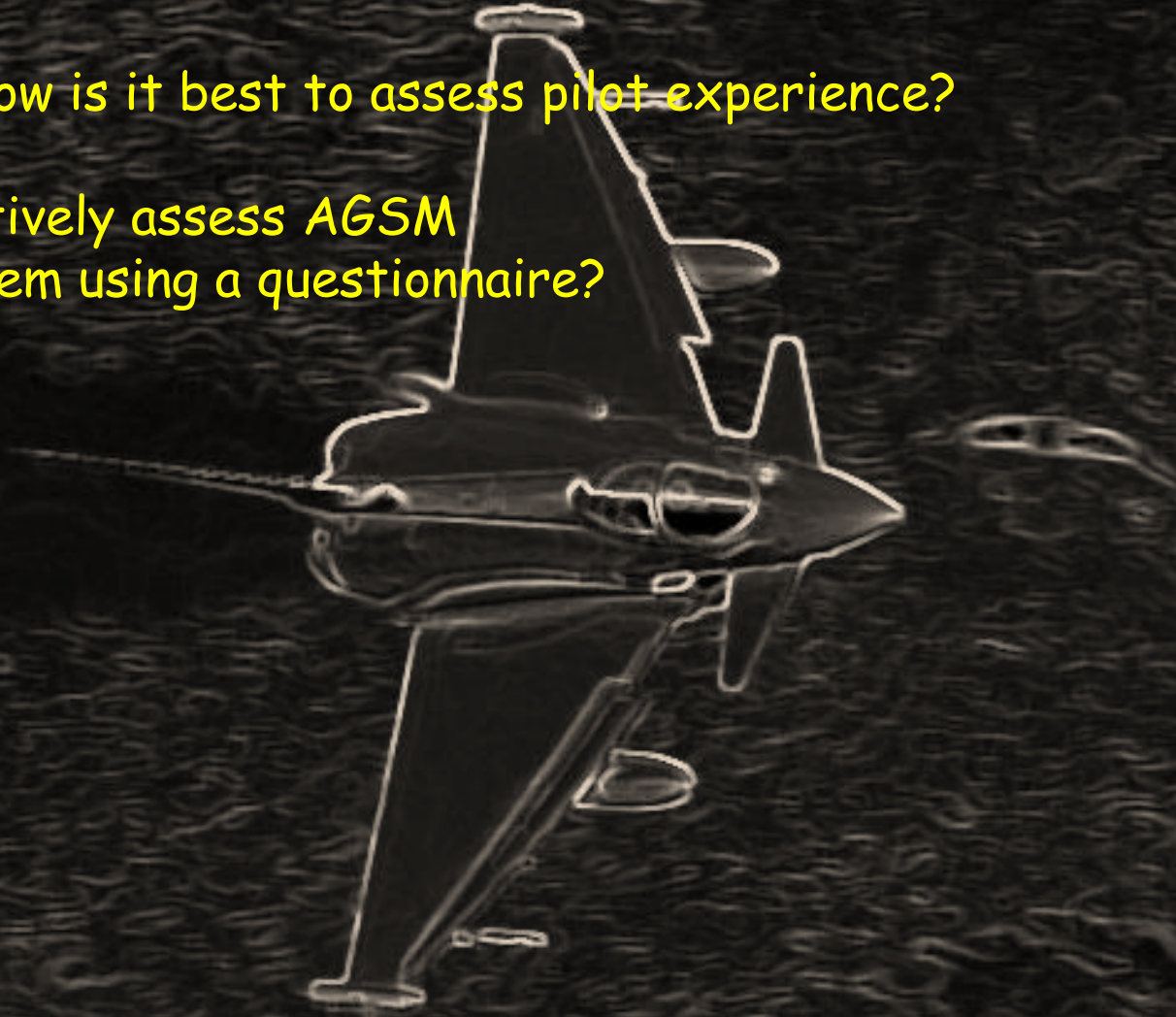
Gotchas.

- Lookout scan v head position
- Arm pain
- Tumbling on slow down
- Neck strength v Mk10 helmet v experience



How is it best to assess pilot experience?

- Objectively assess *AGSM*
- Ask them using a questionnaire?



Appendix C



**HOW EFFECTIVE IS THE ROYAL AIR FORCE HIGH G TRAINING FACILITY (HGTF)
IN PREPARING PILOTS FOR HIGH G FLIGHT AND WHAT FACTORS INFLUENCE
THIS? (QUESTIONNAIRE)**

Course Attending (please circle) Hawk Typhoon Lightning EFTS BFJT Other

Age in years:

How many years have you served:

- | | | | |
|---------|--------------------------|------|--------------------------|
| 18-25 | <input type="checkbox"/> | <5 | <input type="checkbox"/> |
| 26-30 | <input type="checkbox"/> | 6-10 | <input type="checkbox"/> |
| 31-35 | <input type="checkbox"/> | >10 | <input type="checkbox"/> |
| 36-40 | <input type="checkbox"/> | | |
| Over 41 | <input type="checkbox"/> | | |

Gender:

- Female Male Prefer not to say

Rank:

- | | | | | | | | |
|--------------|--------------------------|----------------|--------------------------|----------|--------------------------|---------------|--------------------------|
| Flt | <input type="checkbox"/> | Sqn | <input type="checkbox"/> | Wg | <input type="checkbox"/> | Gp | <input type="checkbox"/> |
| Lt/Capt/Surg | | Ldr/Major/Surg | | Cdr/Lt | | Capt/Col/Surg | |
| Lt | | Lt Cdr | | Col/Surg | | Capt | |
| | | | | Cdr | | | |

Weight in Kg:

- 60-70
71-80
81-90
Over 91

Height ___m

Total Flying Hours

Aircraft types

Hours on current type

Last centrifuge sortie date

Last tour a non-flying tour (please circle) yes no

In your current platform how often have you experienced:

	Never -----	Every Sortie
Grey out (peripheral visual disturbance)	0 1 2 3 4 5 6 7 8 9 10	
A-LOC (deficit in cognitive or motor function without LOC)	0 1 2 3 4 5 6 7 8 9 10	
G-LOC	0 1 2 3 4 5 6 7 8 9 10	

In the centrifuge at Cranwell how often did you experience?

	Never-----	Always
Nausea/Vomiting	0 1 2 3 4 5 6 7 8 9 10	
Dizziness	0 1 2 3 4 5 6 7 8 9 10	
Disorientation	0 1 2 3 4 5 6 7 8 9 10	
Tumbling sensation (Coriolis effect)	0 1 2 3 4 5 6 7 8 9 10	
Arm Pain	0 1 2 3 4 5 6 7 8 9 10	
Visual Disturbance (other than grey-out)	0 1 2 3 4 5 6 7 8 9 10	

How effective did you find the Cranwell Centrifuge in terms of preparing you for high g flight?

Ineffective-----	Highly Effective
0 1 2 3 4 5 6 7 8 9 10	

How effective did you find the scenario-based AGSM practise?

Ineffective-----	Highly effective
0 1 2 3 4 5 6 7 8 9 10	

Are there any platform specific high g manoeuvres you think the centrifuge might usefully replicate? _____

Any other comments to improve quality of centrifuge training?

Methodology



Three key questions:

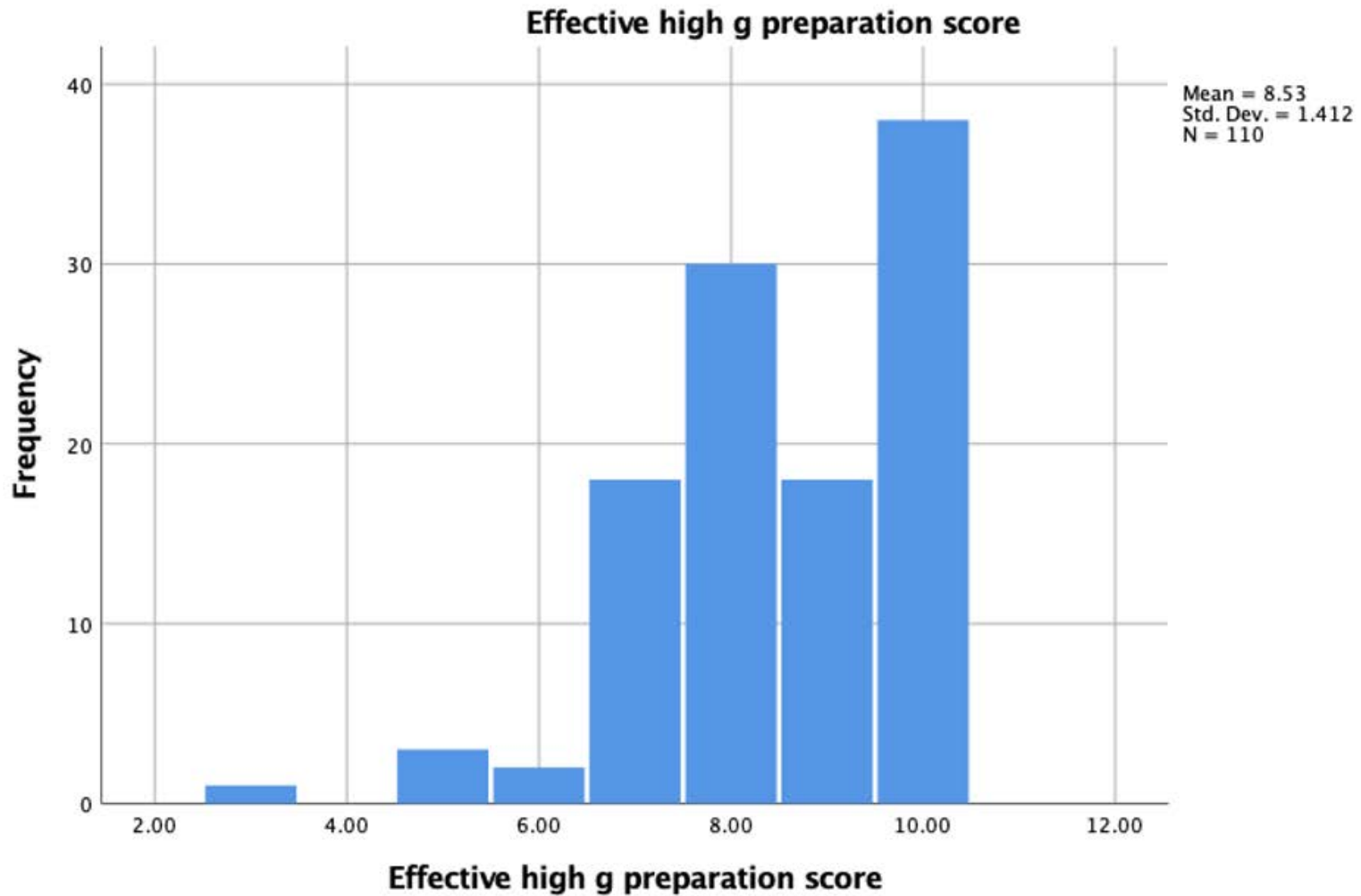
- How effective was the centrifuge in preparing you for high G_z flight?
- How effective did you find the scenario based AGSM practise (DFS)?
- How confident are you in your AGSM technique whilst flying and fighting your aircraft?



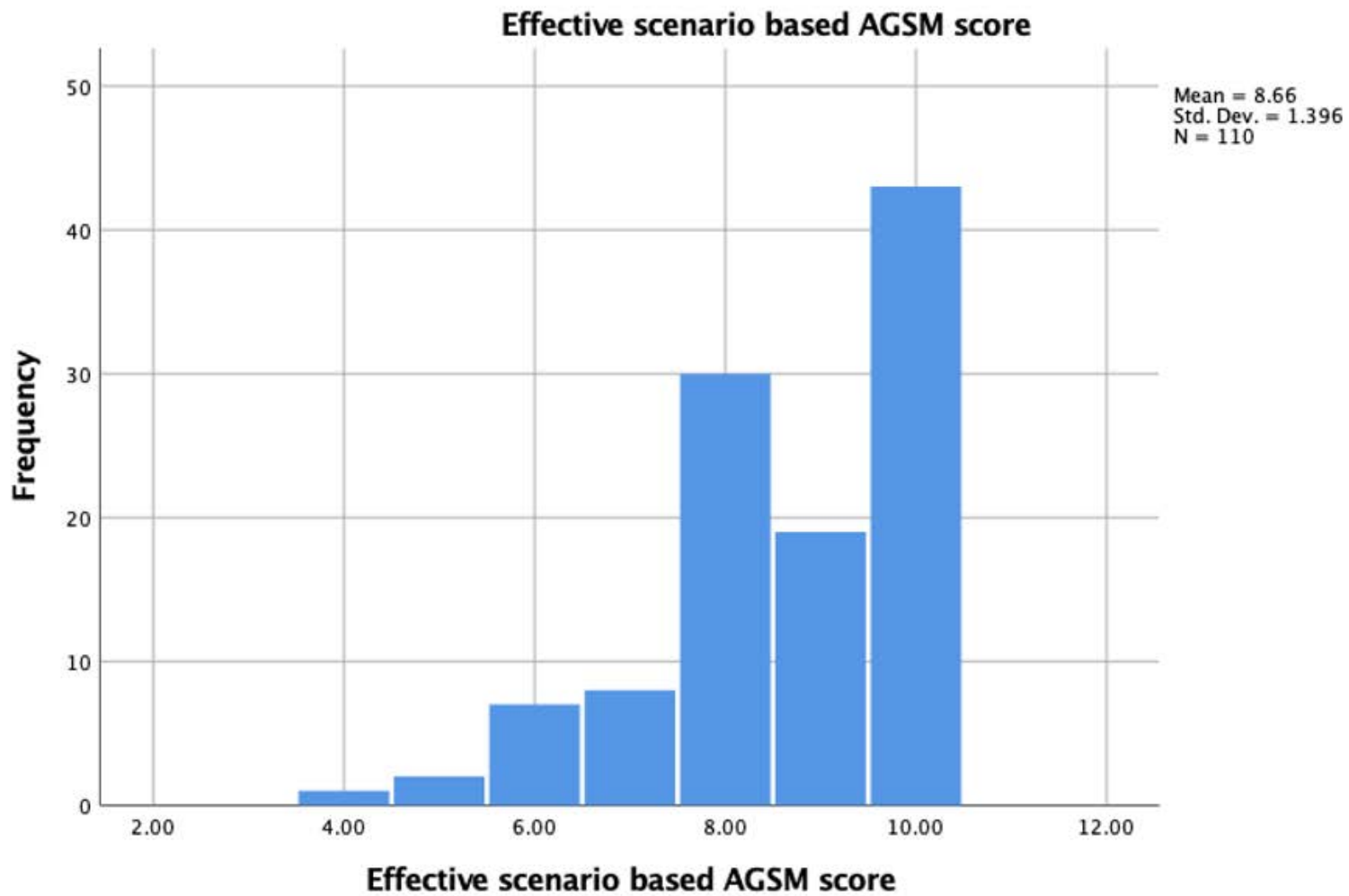
Methodology

- Univariate analysis of pilot demographic v effectiveness score.
- Binomial logistic regression to look at possible predictors of centrifuge effectiveness
- Logistic regression looking at predictors of pilot grey out

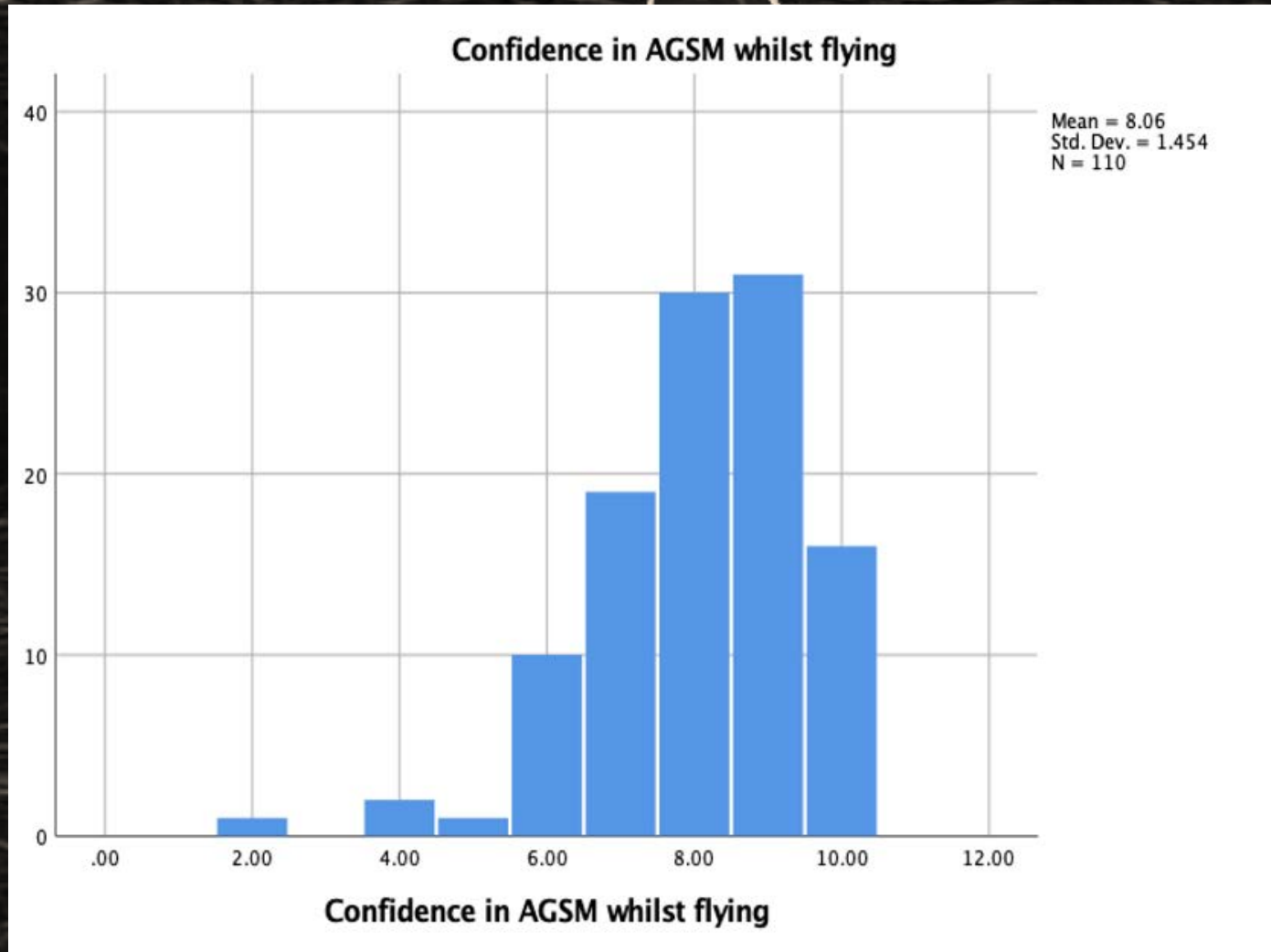
Descriptive analysis results



Descriptive analysis results



Descriptive analysis results



Univariate analysis results.

Summary of Chi-squared analysis findings showing p-value for pilot characteristics vs three key effectiveness questions.

Independent Variable	Q1. High g flight preparation score.	Q2. Effective AGSM practise.	Q3. AGSM confidence whilst flying your ac.
Age Category	0.782	0.441	0.040
Years served	0.705	0.437	0.007
Rank	0.818	0.718	0.170
Height Category	0.653	0.127	0.429
Weight Category	0.976	0.947	0.456
Flying hours category	0.531	0.723	<u>0.020</u>
Aircraft types	0.216	0.797	0.011
Ground Tour	0.016	0.289	0.003

Table 3 - Univariate and multiple logistic regression looking at the crude and adjusted odds of finding the centrifuge effective v less effective¹ for each of the three objective questions – statistically significant in red.

Effective question		Q3	Q3	Q3	Q3
Independent variable	Designator	Crude OR	CI	Adjust OR	CI
Age in years category compared to 18-25 yrs	26-30	4.33	1.42-13.1	1.541	0.010 – 247.79
	31-35	3.90	.96-15.82	3.965	0.028 – 569.74
	36-40	7.80	.80-75.6	3.024	0.042 – 218.8
	41+	4.12	1.2-14.1	1.738	0.082 – 36.768
Years served category compared to 5 years or less	6-10	7.79	1.95-31.2	0.884	0.006 – 133.95
	11-15	2.48	.77-8.03	2.055	0.014 – 303.69
	15+	3.79	1.29-11.2	0.414	0.005 – 34.725
Aircraft types category compared to Prefect/Tutor	Tornado	5.74	1.35-24.3	4.198	0.389 – 45.25
	Hawk	7.79	1.88-32.3	3.309	0.366 – 29.89
	Typhoon	3.69	1.06-12.8	2.905	0.329 – 25.627
	Tucano	3.28	1-10.79	3.259	0.444 – 23.918
Ground Tour	No ground tour	3.6	1.5-8.5		
Flying hours Category compared to less than 50hrs	51-100	1.92	.38-9.8	0.338	0.007 – 15.869
	101-200	1.6	.33-7.85	0.649	0.013-33.23
	201- 400	22.4	2.2-227	0.275	0.005 – 13.91
	401-900	6.40	.95-43.2	1.139	0.018 – 73.4
	901-1500	2.80	.53-14.7	0.357	0.009 – 13.84
	1501-2000	16.0	1.5-166	0.558	0.034 – 9.04
	2001-3000	9.6	1.5-62.2	3.98	0.186 - 85.37
3001+	3.6	.71-18.2	2.28	0.269 – 19.4	

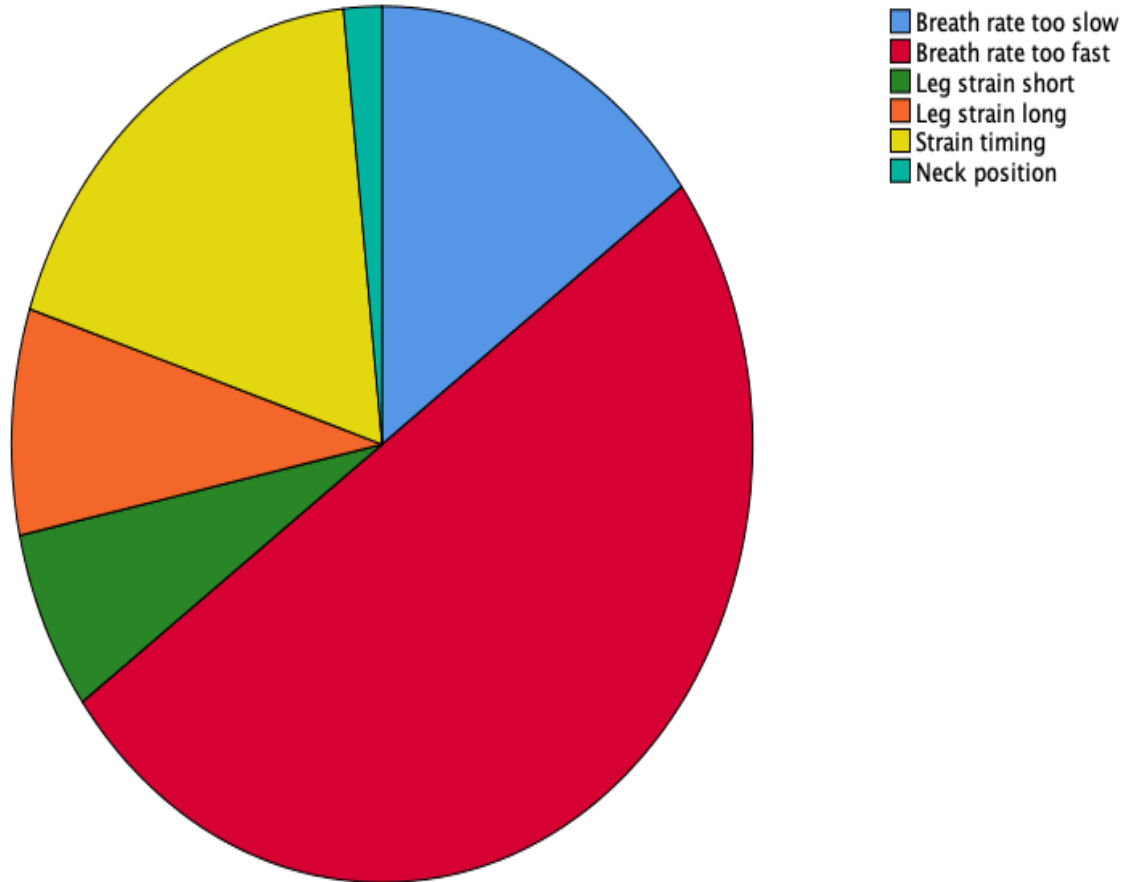
Only ground tour showed significance for Q1 – OR 3.05 CI 1.2-7.75. No significant results for question 2.

Ordinal logistic regression

The results of ordinal regression for the dependent ordinal variable grey out demonstrate that none of the age categories, years served, or hours flown categories produced significant results in predicting pilot grey-out; however, flying Typhoon aircraft demonstrated a significant predictor of grey-out category when taking into account predictors of age/years served and hours flown when comparing this group against Tutor/Prefect pilots, OR 17.62 CI 3.2-95.7.

AGSM Errors

Common AGSM Errors



Conclusions



- Both effective high Gz preparation and confidence in AGSM are related to absence of a ground tour.
- Pilot age, platform type, flying hours and years served are all factors which were associated with confidence in AGSM.
- Pilots in the 26-30 and 41+ years age group were significantly more likely to report being confident in their AGSM when compared to the 18-25 years group.
- Pilots who have served 6-10 years and 15+ years were significantly more likely to report being confident in their AGSM when compared to pilots with 5 years or less service.



Conclusions

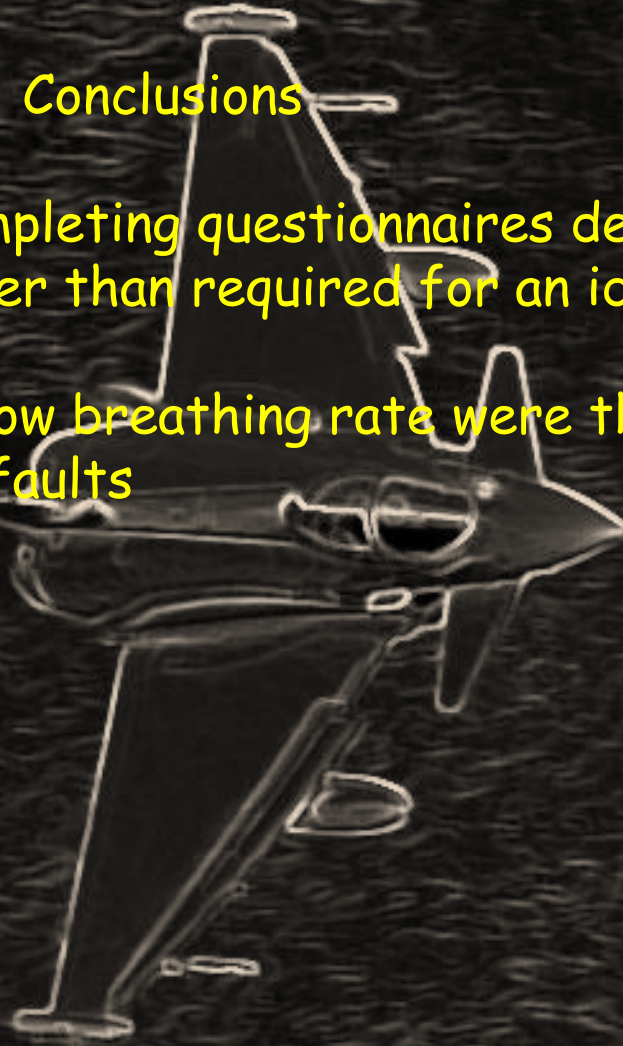
- Tornado, Hawk, Typhoon and Tucano pilots were significantly more likely to report being confident in their AGSM when compared to Prefect/Tutor pilots.
- Pilots in the 201-400, 1501-2000 and 2001-3000 flying hours category were significantly more likely to report being confident in their AGSM when compared with pilots with less than 50 hours flying.

Conclusions

- When combining pilot age, years served, aircraft type and flying hours, no significant pilot characteristics can be used to predict confidence in the AGSM.
- Typhoon aircraft pilots demonstrated a significant association with increasing pilot grey out score when taking into account age, years served and hours flown when compared to Tutor/Prefect pilots.
- Pilots in the 26-30 and 31-35 years category demonstrated a non-significant, negative relationship with pilot grey out group when taking into account confounders.

Conclusions

- Half of the pilots completing questionnaires demonstrated a breathing rate faster than required for an ideal AGSM
- *G* strain timing and slow breathing rate were the next most common AGSM faults





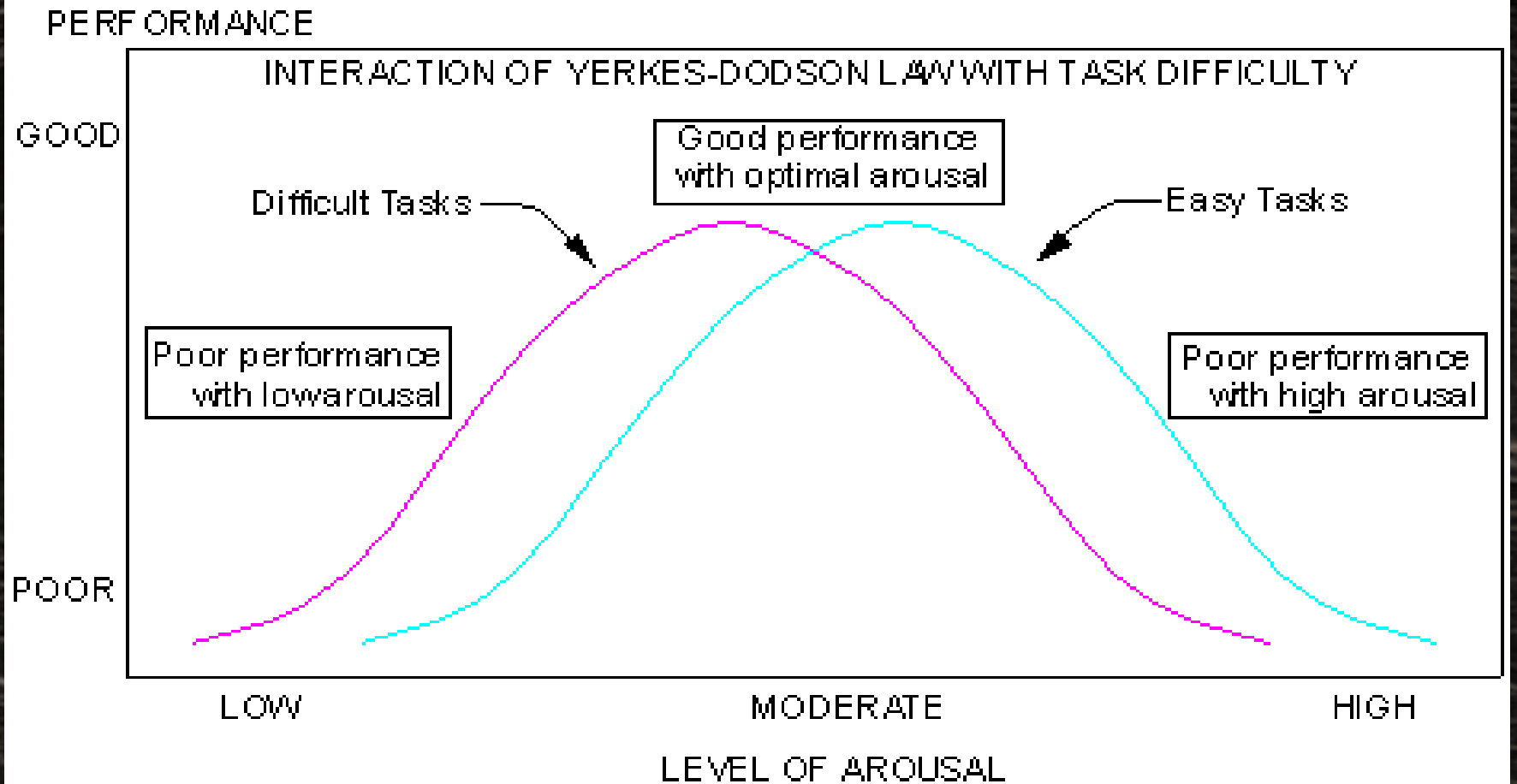
So what?

- Target the new arrivals (zero flying hours) and think about centrifuge currency?
- Target those who have been away on a ground tour and alter their centrifuge currency?
- Reassure open culture about reporting of G_z symptoms, A-LOC and G-LOC and use of centrifuge as a training tool to help?

So what?

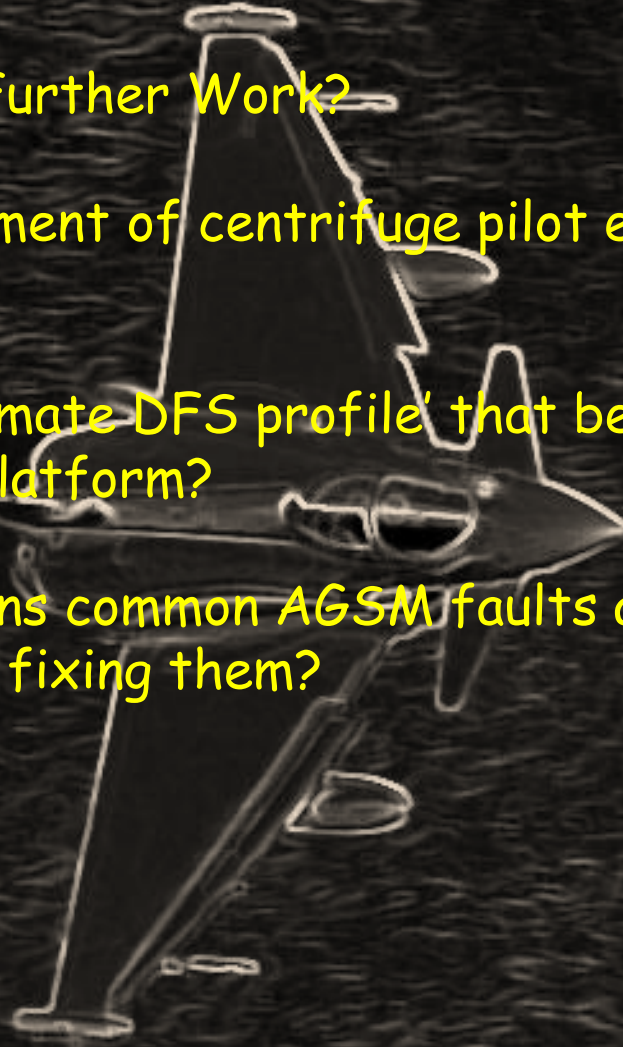
Figure 8 - 7

Hamilton - Timmons



Further Work?

- Other nations assessment of centrifuge pilot experience and use of DFS?
- Can we create an 'ultimate DFS profile' that best trains the AGSM for each platform?
- What are other nations common AGSM faults and how have they gone about fixing them?





QUESTIONS?