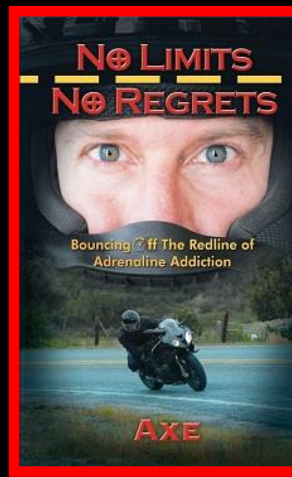
Mitigation of Marginal Areas of Performance Plan (MMAPP)

Dan "Axe" DeKruif (record breaker for fastest motorcycle ride across America)

"No Limits - No Regrets" book c/o Y Chrome Customs LLC (ychrome.com)

[Patent Pending 61/933,152]



INTRODUCTION

Activities performed by such humans as members of the military or athletes can occur under extreme conditions compared to the traditional workforce. Targeted performance training, ergonomics, equipment, and accessories have been used for years to improve extreme activity performance. However, a more scientific approach can be applied if we consider the body for what it is; a very complex machine. When electromechanical devices are designed, engineers conduct a Failure Mode and Effects Analysis (FMEA). Human performance in a system can be improved by applying these same principles with a Mitigation of Marginal Areas of Performance Plan (MMAPP).

METHODS

An activity must be chosen that will benefit from application of the process. Creation of a system diagram will help identify the interactions among the human and the machines. The human must be studied while performing the activity as part of the system, so potential failures can be identified and classified. Photos of the human during performance with proper notation can depict the Marginal Areas of Performance (MAP). Potential failure points identified on the MAP can be viewed as risks and entered into a FMEA table. Mitigations identified in the FMEA become the framework for creating the MMAPP. Once the MMAPP has been implemented, testing can be repeated to determine effectiveness of the MMAPP in terms of performance improvement. The process flowchart is shown in Figure 1. MMAPP Process below.

Figure 1. MMAPP Process

ANALYSIS

Figure 2. FMEA Excerpt shows a sample of the tool used to analyze potential failures, criticality, and mitigations. Figure 3. Risk Table illustrates the acceptability line for the final Test 3.

5.3 CO-TX ride														5.9 CA-FL ride		
Comp-onent	failure mode	failure effect	Fail-ure ID	S	O	C	potential failure causes	MT	recommended mitigations	Counter-productive effects	S	O	C	action	test results	recom-men-dation
H-AXE	Exces-sive stops	delay task com-ple-tion	FA13	2	5	10	hunger or thirst	S, PS	retain packed snacks and replenishing fluids	Low, reduced mileage and comfort	2	3	6	R	n/a	n/a
			FA14	2	5	10	helmet removal to replenish fluids	E, S, PS	E-BAG uses camel pack instead of bottles	n/a	2	3	6	A/R	n/a	n/a
			FA15	2	5	10	bladder or bowel voiding	n/a	in flight method such as condom catheter or adult diapers	Med, increased discomfort	2	1	2	A/R	n/a	n/a
			FA16	3	5	15	physical fatigue	PP	sleep before activity	n/a	3	2	6	R	n/a	n/a
			FA17					PP, S	replenishing fluids include energy drinks	n/a				A/R	n/a	n/a
			FA18	2	5	10	discomfort	PP	flexibility training	n/a	2	3	6	R	n/a	n/a
			FA19					PP	stretch before activity	n/a				R	n/a	n/a
			FA20					PP	avoid very cold weather	n/a				R	n/a	n/a
			FA21					PP	avoid very hot weather	n/a				R	n/a	n/a
			FA22					PS	stretch during stops	Low, increases stop time				R	n/a	n/a
			FA23					n/a	focused exercise in trapezius	n/a				R	n/a	n/a

Figure 2. FMEA Excerpt

Severity	Description	Severity	Risk Acceptability				
5	death	5	5	10	15	20	25
4	permanent effects (legal record/injuries)	4	4	8	12	16	20
3	major effect on primary objective	3	3	6	9	12	15
2	minor effect on primary objective	2	2	4	6	8	10
1	annoyance	1	1	2	3	4	5
			1	2	3	4	5
			Occurrence				

Figure 3. Risk Table

TRAINING

- **Flexibility** – stretching for areas (ex. knees) well outside natural balanced joint position per Figure 4. Marginal Areas of Performance (MAP)
- **Stamina** – endurance for areas (ex. trapezius) subject to load bearing
- **Sleep** – adapted nocturnal pattern to improve night alertness
- **Mental** – established complete focus on task success to eliminate potential distractions and increase personal risk tolerance

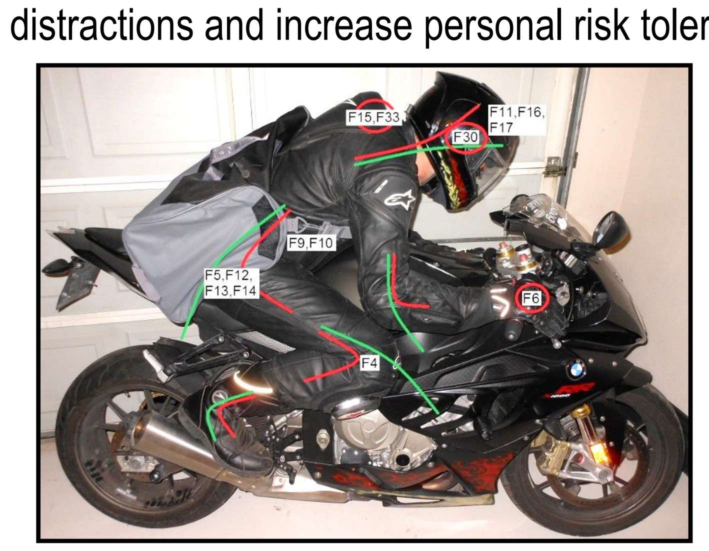


Figure 4. Marginal Areas of Performance (MAP)

TECHNOLOGY

- **Detector** – law enforcement bogey visual and audible alerts
- **FLIR** – thermal vision system for night identification of animals and other road obstacles to allow overdriving of headlights, 3D printed mounts
- **Tank** – additional 5 gallon fuel capacity mounted to tail and plumbed to primary tank for in-flight fuel transfer.
- **Mileage** – sprocket change for theoretical 12% mileage increase
- **Phone** – central communication receiving detector signals and providing music, calls, and alerts through Bluetooth® to helmet

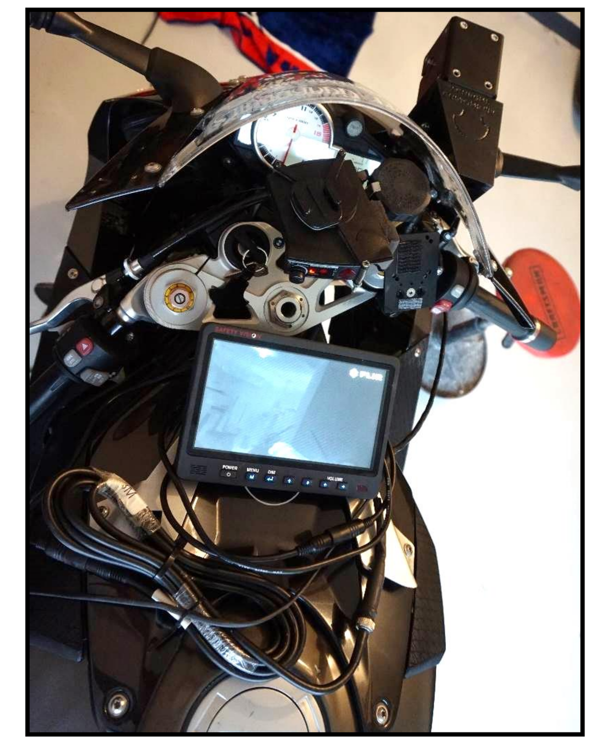


Figure 5. Detector & FLIR

INTAKE/VOIDING

- **Diet** – MRE's eaten for 3 days prior, 2 beef jerky sticks during
- **Fluid Bladder** – 3 liter storage of energy drink and rehydration mixture plumbed to helmet for in-flight replenishing
- **Catheter** – condom style attachment with open exit fastened to boot for bladder voiding
- **Diaper** – bowel voiding

EQUIPMENT

- **Helmet** – head protection as well as Bluetooth® for detector alerts and phone communication/music
- **Suit** – body protection and comfort (ex. temperature control)
- **Gloves** – hand protection and comfort (ex. vibration damping)
- **Boots** – foot and ankle protection
- **Firearm** – crime protection

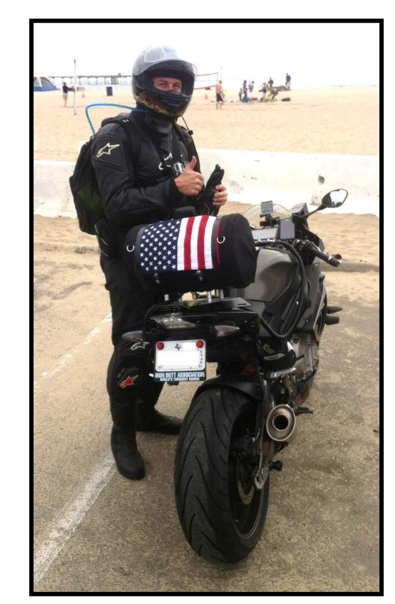


Figure 6. Takeoff

ERGONOMICS

- **Throttle Lock** – provide rest of throttle thumb during constant velocity periods
- **Leg Rests** – allow alternate seating position of legs on passenger pegs
- **Bag** – backpack style distributed load, reducing pinch point compared to single strap bag

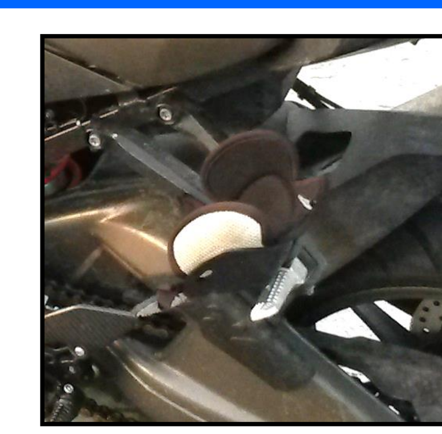
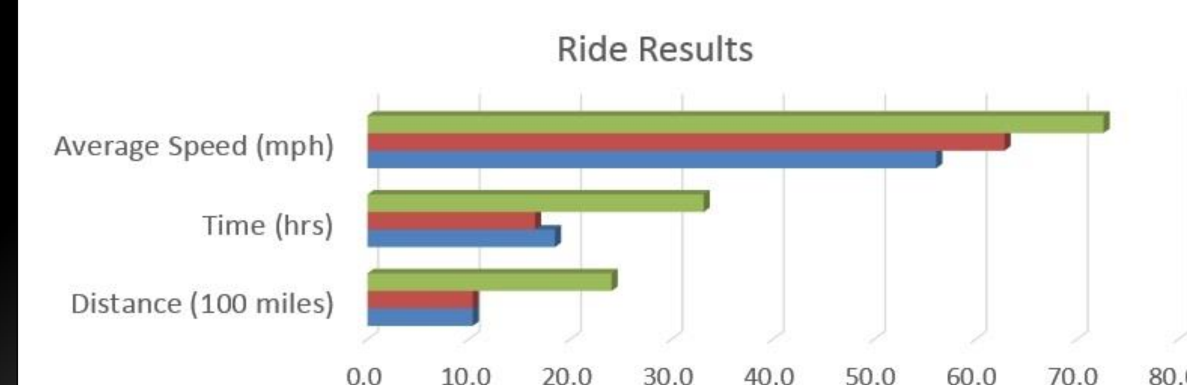


Figure 7. Leg Rests

RESULTS

The MMAPP was applied to a long distance motorcycle ride requiring focus of the human subject while experiencing deprivation of sleep, food, and replenishing fluids. Test 1 was conducted for a 1000 mile solo ride and took 18.5 hours for an average speed of 56.1 mph. Data gathered from Test 1 was used to prepare an MMAPP for the task. The basic characteristics of the motorcycle were considered constraints, but equipment, accessories, and training were implemented. Test 2 was conducted with the same motorcycle and distance yielding a time of 16.5 hours and average speed of 62.9 mph for an improvement of 12%. A second MMAPP was written, which opened limits previously accepted as constraints. With a much more aggressive MMAPP implementation, Test 3 was conducted and resulted in an average speed of 72.6 mph for improvements of 15.5% over Test 2 and 29.4% over Test 1. The more impressive fact is that Test 3 was conducted for a continuous solo distance of over 2400 miles. At 240% of the distance for previous tests, the mental and physical stamina of the human subject were stressed at considerably higher levels while still accomplishing a vastly improved average speed. This resulted in Test 3 breaking the previous cross country motorcycle record of 2232 miles in 36 hours with no gas stops.[1]



Test	Distance (miles/100)	Time (hrs)	Average Speed (mph)	improved from previous (%)
1. TX-CO ride	10.4	18.50	56.11	-
2. CO-TX ride	10.4	16.52	62.85	12.0%
3. CA-FL ride	24.1	33.17	72.61	15.5%
			improvement 1st to 3rd test (%)	29.4%

Figure 8. Ride Results

CONCLUSIONS

The test results showing a 29.4% improvement after two rounds of MMAPP implementation illustrate the effectiveness of this process. By analyzing the human like an electromechanical component, one can implement human level mitigations to drastically improve a human's performance in a system instead of accepting limitations often treated as constraints for the weak link in the system. By opening the formerly accepted limits and applying the MMAPP process, higher levels of human performance can be achieved.

CONTACT INFORMATION

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1. Joe Taylor, *No Brake in the Action* (San Diego, CA: U-T, 2008)