Fact Check – Manufacturer Testing.

As you know little ZFC has been pretty passionate regarding having independent testing up and running again after Friction Facts was purchased by Ceramic Speed – and also due to the fact that much was left to be done with regards to longevity testing which more closes represents how real world cyclists use products vs short contamination free efficiency tests. Also new products and tech with big performance claims are hitting the market all the time, and need to be properly and independently assessed to sort what may be a great new product that has landed vs what may have serious question marks regards its performance claims.

The simple fact is that consumers are forever faced with some tricky product selection dilemma's. No manufacturer brings a product to market saying "This is a really, really average product. It doesn't do anything special at all, and is probably overpriced vs other products for what it does".

Every bottle or box or packet of anything we pick up to spend our hard earned money on will claim various wonderful attributes about itself. The claims, the brand name, the packaging and the price are mostly what sits behind our decision re selecting one product from another.

So a well marketed and packaged product may out sell 10 to 1 over another product that may be clearly superior in how it performs, and possibly cheaper. For much of what we purchase, the battleground is fought mostly on the marketing front, as opposed to the actual product performance front. Trying to ascertain the actual product performance tends to be a very difficult, subjective and grey area.

Manufacturers have pretty much carte blanche on putting forward any performance claims they like as there has been no accountability. At the end of the day they need to make a profit on a product they have spent $ on bringing to market, so regardless of if it may genuinely be the best thing since sliced bread or a product you could surpass by randomly mixing things together from your pantry – you will not be able to tell one from the other by what is printed on the packet or the price.

Like all markets – there are very honest manufacturers with great products, some more questionable behaviour re performance vs marketing claims where a manufacturer may be exploiting their brand name / marketing power, or it can be that some manufacturers may exploit a clever marketing angle that hasn't been exploited before, and of course there is every shade in between. Part of what ZFC is working hard at in our little sphere of product focus is to sort who is doing what, and make product selections and recommendations accordingly.

I feel rather strongly that manufacturers who have put a genuine huge effort into delivering a great product to market should be highlighted as such through independent testing. Likewise for manufacturers who have either inadvertently missed mark with a products performance but claiming it is all that and a bag of chips anyway, or worse - knowingly brought a heap of crap to market and claiming the world about it – sometimes taking advantage of a clever new marketing angle ***(Queue a rather notable "user simply rubs the wax onto the chains rollers, resulting in a race ready chain in seconds" or another company releasing a product packed with laser crafted nano balls – which testing subsequently showed actually made the base lubricant slower etc).***

It is an unfortunate fact that there are a lot of great products out there that are lost in the sea of every product claiming it is amazing too.

Wont the actual performance of a poor product soon be apparent and consumers steer clear? In the absolute worst cases this does happen to a degree, but not as often as you would think. A well marketed product from a big name brand will simply continue to sell. Bike stores and online stores will continue to stock front and centre because they know the product will sell. There are some lubricants from established brands that are shockingly poor, delivering very high friction and drive train wear rates – yet of course they are marketed as an amazing lubricant and continue to be a big seller year after year with consumers not realising they could halve their drive train friction and running costs by choosing a different lubricant.

Most consumers will simply not know if it is good or not, and rely on the marketing and the recommendations of people who should know – i.e the ones they are talking to in a bike store. So a lubricant eats through their chain and cassette in 3000km. Is that normal? I ride through all conditions, I put out a fair bit of power, it looks and feels ok and it says all these cool things on the bottle like it cleans as it lubes, penetrates deeply to flush out contamination, forms a protective film over the metal etc, it is from a big name brand and the bike store guy recommended it so this must

be what a good lube is like right? I doubt anything else will do any better, and maybe it will be a lot worse if I try something else.

Or a customer has tried one product, thought it was poor / average, tried another which was similar, tried another which was similar, and then just given up trying any more for a while as believed that the level of performance they are seeing is the apparent good level of performance the products have been claiming. Again a lot of the big brand stuff stocked by LBS and major online stores is stocked simply because it is believed by consumers the big brands claiming big things about their products performance can be trusted, and so they keep reliably flowing out the door / warehouse. A lot of these products are not necessarily poor, but most are in a big beige area of "meh" performance.

Out of the 55 lubricants that FF originally tested out of the top 10 you will be lucky to find one of those at your local LBS. You are likely to find one or two from the bottom 15. And all the rest will be from that big middle area of "meh". These 30 lubes make up the majority of lubes sold by big name brands that you will find front and centre at LBS, and whilst many are not necessarily poor products, when you really compare what they claim on the bottle / website vs what they are actually delivering, typically you can expect to find quite a yawning gap between the two.

Reviews by cycling publications are unfortunately rarely a good guide in this area. They receive a sample of the product from the manufacturer, along with a big marketing spiel about how wonderful it is, take it on a ride or two, it feels like a lubricant, the same ol lines are trundled out about how it felt low friction and they noticed no lag in shifting or chain such (who does after 1 or 2 rides on a lube?!), write up an expanded version of the marketing spiel to make up the bulk of the article, and there it is folks – there is your review.

One doesn't have to look far to find great reviews on lubricants that are frankly…… terrible. Let us have a quick squiz at White Lightning Epic ride. This tested at a rather astounding 9w of friction losses on a perfectly clean chain in a lab, which for a very light bodied lubricant is eye wateringly poor – 9w could probably be bested by motor oil from your car engine - ZFC testing has also shown this lubricant just eats through drive trains. I also managed to get my test chain efficiency tested post ZFC longevity test – its friction was so high it was literally off the test machines scale. And that was after just 2400km of running in the ZFC test. And yet a quick surf on the internet on WLER reviews, and here is an excerpt from the first one that pops up;

"White Lightning Epic Ride light lube sounds like a contradiction in terms but the combination of low friction and relative tenacity will win friends among racers, club, audax and even mountain bikers looking for a thin, yet durable lube"

And later in the review;

"Friction is notably absent on ultra sensitive nine/ten speed derailleur configurations, cantering up and down the cassette with remarkable finesse"

This is something one see's over and over with most of the objectively ascertained poor performing lubricants, and you see the same with medium or great performing lubricants. Sometimes a really good lubricant gets a poor review for one reason or another.

In summary – I'm not taking aim at online publications here as honestly they are up against it on this front – lubricants are just almost impossible for one to objectively performance test by taking on a ride or two (with one's subjective mind already filled with marketing fluff about what it is apparently doing). However readers expect online publications to test and review stuff – including lubricants – and so reviews you get.

But as we now know – the impact of a lubricant on drive train performance is huge, there are literally anywhere from 2 to 10w+ difference to be gained or lost after a ride or two in the real world from choosing a top lubricant vs a poor lubricant (and likely a similar correlation with your drive train wear rates). This is driving force of why ZFC has focussed so strongly on best lubricants and chains as our core products, backed by both our own objective testing in correlation with previous FF testing where available. This area is much more important than bearing upgrades, and so ZFC has been working hard to expand on the ground breaking work of FF for both our own and all cyclist's knowledge re product selection.

It is an impossible task for cycling publications to properly review lubricant performance regardless of their best attempts, and without objective independent testing the sea of every product claiming it is amazing will continue to have many consumers short changed on performance and running costs.

In comes hard data from Manufacturer Testing.

Over the last 5 years or so, the marketing battleground has become a whole bunch more fun.

Many major players in the industry invest heavily in equipment and testing for their product development and proof of claims. On the surface one would think this **should make things clearer for the consumer** – if one can see actual tested data as proof re what sits behind a products performance claims – this is a very powerful tool to convince a consumer to buy that product vs a product from another manufacturer that is simply all claims and no tested data.

This is a key reason why the larger manufacturers invest heavily in this area – part one is to greatly assist with product development, and part two is they can provide the hard data to back their claims once they have nailed the products performance objectives. They have the ability to prove in black and white the performance of their product and the claims that go with it – often with comparisons against competitor's products. You rippa! What could go wrong?! ☺

Unfortunately – the reality is things have turned out to be not so nice and simple (it never does!). We get the data and comparisons from the manufacturer alright to back the claims, the trouble is their competitor will also have the same on their product that shows the opposite result.

A lot of consumers know that they should take manufacturer testing which shows their product to be numero uno with a bit of a grain of salt, however in general it still presents a powerful argument. Despite the grain of salt, test data will often sway the consumer to purchase that product over another that doesn't have hard performance test data being shown to back their claims.

At the time of writing I could probably compile a list of around 50 bicycle lubricant manufacturers. If I wrote to all of them and asked them if their particular product was the top choice of lubricant in its class and should I buy that one – I will get 50 replies confirming yes – their product is the best, I should buy theirs over the others. An increasing number of manufacturers are providing test data to support their claims.

This understandably leads to a good bit of confusion. Which manufacturers claims are correct (or at least the most correct…) needs some proper time and effort put in. The devil is in the detail of the testing – How was it done? How extensively was it done? How was it measured? How were their competitor's products tested? The trouble is we often do not have access to the detail – what we get is just the marketing level wrap of the testing – presented in a manner that makes the manufacturers product look how they want it to look – which is taking the number one position.

Most product development and testing is pretty detailed and complicated, and invariably different manufacturers will use different testing equipment and protocols – which can make comparing even black and white data something similar to comparing apples with oranges.

In short – there are more grey area's than most would suspect in the world of product performance testing – even when manufacturers present end data in the same fashion of "X" watts lost at "X" watts power output and after "X" hours of running.

So, with one of my usual far too long preambles done to set the scene, this document is mainly aimed to help readers / consumers understand conflicting test data and number one positon claims made by different manufacturers at the same time.

A key goal behind ZFC is also to help clarify information, and so where possible to see which tests and claims pass scrutiny. My belief is that if a manufacturer has nailed developing a best in class product and has genuine, robust testing and data to back it – the best thing ever is someone asking them questions about said testing / data. As they worked so hard to achieve and succeed with their

products performance, it is like their baby – they are super proud of it and they want to shout about it from the rooftops to whomever will listen.

As such I do find it rather odd when I write to a manufacturer with questions around what sits behind their product performance claims / data and they literally run for the hills.

This situation was presented quite starkly in round one of the ZFC lubricant testing. If I wrote to a manufacturer for more detail on what sits behind their marketing claims and I received obviously excited replies and answers to any and all questions no matter how much I pummelled them for detailed specifics – it was no surprise their product tested very well.

If I wrote to a manufacturer and received back just a re-iteration of marketing fluff and nothing specific, followed by them running for the hills never to answer an email from me again when it is clear I am looking for specific detail on what sits behind the claims, it was no surprise their product had tested very poorly in ZFC testing.

A CASE IN POINT

For this document re manufacturer testing I have chosen as a case study the rather amazing but also very worrying opposing performance claims situation between Muc-Off and Ceramic Speed.

On one side, we have Ceramic Speed with UFO wax chains claiming efficiency losses usually around the 4 to 4.5w mark, and that wax is almost immune to friction increases from contamination during riding due to being solid.

Muc-Off claim low 4's re efficiency losses for their Nano Chain, remaining stable over a 4hr test, whilst at the same time showing that UFO chain has a notable drop in efficiency starting at just 18 minutes, and with a whopping 10 watt+ increase in efficiency losses after just 4 hours.

So the two most powerful brands regarding optimised race chains are putting up vastly different figures and claims regarding performance. Running a 4watt chain vs a 14watt chain would be rather important data to consider for anyone looking to spend circa $170 for a race chain. So with supposedly hard data being supplied – chains tested and showing X watts loss at X power over X time, how can there be such a discrepancy in the marketing claims? Shouldn't such testing be apples to apples?

It is exactly that question which to me strikes right to the core of the issue. We should be able to make our decisions based on hard and fast apples to apples comparable data showing a products performance – It is X watts efficient at X power and degrades X amount over X time with X level of contamination introduced at X points in the testing. How can we have a situation where two of the most powerful brands - both of whom have invested tens of thousands of $ in the most state of the art testing equipment (and both of which test in exactly the same way mind you) - arrive at completely different performance claims?

How is your average consumer looking to purchase a race chain for an important race possibly able to decide which manufacturer is showing the correct testing and data?

To understand how the major discrepancies came to be and why I believe this case study is so important, first we need to go through a quick bit of information on the testing equipment and how it works. Trust me it is worth the few minutes reading on next section to understand.

Full Tension Test machines and Full Load Test machines (Endurance machines).

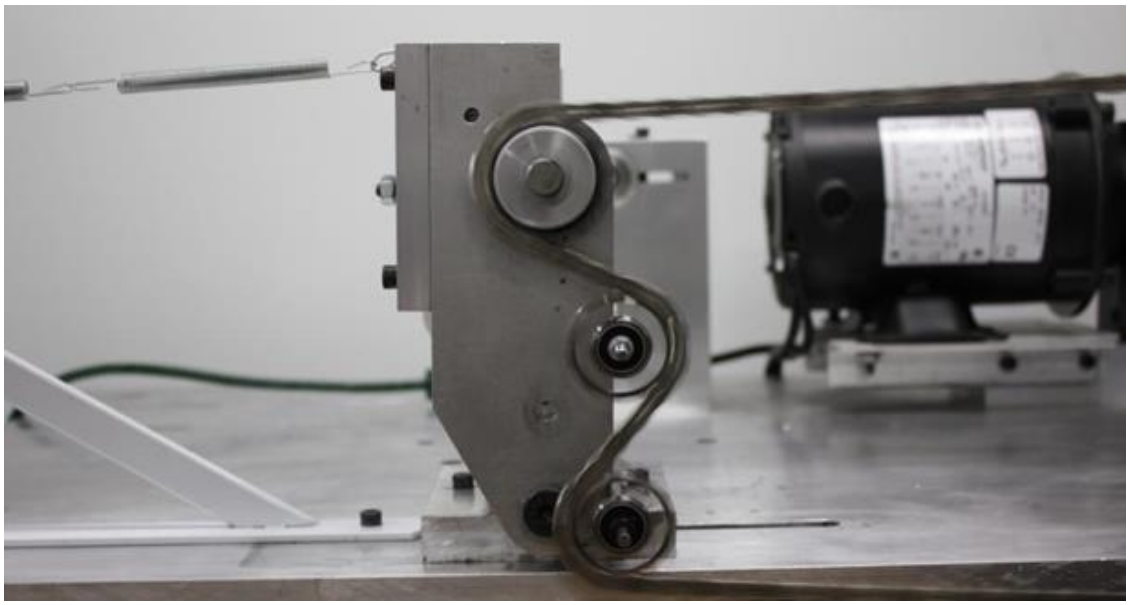
Thanks to the pioneering work of Friction Facts – there are a couple of fundamentals regarding lubricant testing that we can rely on – and which manufacturers need to abide by – to provide accurate test data.

Let us start with the main test equipment. You may have heard of a machine called an FTT machine – Full Tension Test Machine. As opposed to a set up like a bicycle drive train, a Full Tension Test machine looks like a single speed set up. A key difference however is that a weight pulls back on the rear cog putting tension in the chain equivalent to 250w load. The most important aspect to note here is that load tension is in both the top and bottom spans of the chain, whereas on a bicycle pedalling load is through the top span of the chain only, and the chain is under no tension ("slacking") through the bottom span. **This is a very important difference.**

It was found that the FTT method was the most precise way to measure efficiency losses. In the simplest explanation you have an amount of energy input at one end, the amount of energy received at the other end, and $6000usd torque sensors at both ends measuring what went in vs what is coming out to 0.01w accuracy.

(Above – Full Tension Test Machine)

An FLT machine – or Full Load Test machine – also runs at 250w load but this is set up just like a bicycle drive train. As such it has a chain ring, a cog, and pulley wheels. This means the chain goes through the same load cycling as a proper bicycle drive train – with full load going through the top span of the chain only, and almost no load – ***"slacking"*** – through the bottom of the drive train. You can get very accurate measures via a high end FLT machine, but not quite as accurate as with an FTT machine.



(Above – A Full Load Test Machine)

Friction Facts started with building a Full Tension Test machine to test the theory re this being the most accurate method of measuring efficiency losses – which in the years that followed has been upheld.

However – it was also noticed that many lubricants suffered from a sudden increase in efficiency losses if run for extended periods on the FTT machine. When rested and re started – the lubricants efficiency losses would return to the levels prior to the sudden increase.

It was theorised that many lubricants – but not all – needed the slacking time through the bottom of the drivetrain for molecules to reset and re align. If kept under constant load without the slacking time through the bottom of the drivetrain their efficiency can be markedly affected.

Hence the construction of a Full Load Test machine. Here the same lubricants that showed a sudden increase in efficiency losses on the FTT machine do not do so on an FLT machine.

Subsequently Friction Facts released a paper on this, and henceforth the correct testing protocol (in short) for any manufacturers who have had the $ to invest in FTT and FLT machines is too;

1) Gain an accurate initial efficiency loss measure on the FTT machine.
2) Move chain to FLT machine – also often referred to as the **"Endurance Machine"** – to run for whatever period is required for the testing protocol being undertaken – be it 30 minutes, or 90 minutes, or 4 hours or 14 hours etc. This is also where any contamination is added if that is in the test protocol. Whilst the FLT machine is not as outright accurate a the FTT machine – it is still an extremely accurate piece of kit, and will ensure the desired test load is run far more accurately than what one could ever achieve using a power meter set up.
3) Move chain back to FTT machine at determined periods (ie every 30 mins or every hour) for the most accurate efficiency loss check, then move chain back to FLT / endurance machine to continue the run time of the test protocol.

One of the services that Friction Facts used to offer was selling FTT and FLT machines to those manufacturers who had the resources to purchase – or as a consultant with regards to them building their own.

(There is one manufacturer who claims to have designed and built their own machines (after Friction Facts had all information re FTT / FLT testing protocols released and published, and the FTT / FLT machine services on offer), called it a different name, claim they won national design awards for it etc – and wouldn't you know it strangely both machines look ***exactly*** *the same as the Friction Facts machines, and perform the exactly same functions of FTT and FLT.)*

Righto – testing equipment and methodology basics down pat – let us move onto the actual case study re two manufacturers testing to prove they are number one whilst using the same testing equipment and methodology outlined above.

To begin I just need to quickly cover off what is known and proven re Paraffin / MSW and UFO wax.

When Friction Facts commenced and was testing lots and lots of lubricants of all types, including some old wives tales like olive oil etc – one of those was paraffin wax. The results were so surprising initially FF thought the test machine was broken. Further testing and much investigation later – FF had an understanding as to why paraffin made such an exceptionally good chain lubricant. In short – aside from being a really slippery wax – it had a lower "stiction" or starting friction (remember links articulate a bit and stop, reticulate back and stop – and there are many sliding surfaces per link to start moving from a static position), and the wax being solid also has zero viscous friction. Considering a chain has round 40,000 link articulations a minute – little things like this really added up to have paraffin turning out to be an exceptionally efficient chain lubricant.

And as a super bonus – being solid – it was the simulated longevity testing with added contamination where it absolutely slaughtered the completion. Whilst liquid lubes have contamination stick on contact, it simply bounced off the solid wax chains. This had the wax performing just as well at the end of one hour contamination tests whilst the drip lubes (all bar one) had notable to significant friction increases – up to 4w increases in a single hour.

From there – much fun was had. A whole bunch of different additives and friction modifiers were tried, and at different ratio's – the end of which we had Friction Facts starting a side business called Ultra Fast Optimization, and the first ultra low friction race chains were brought to the market. At the same time, a cool guy helping FF out with all this fun started selling the wax blend itself – and thus Molten Speed Wax was born. After a little while Ceramic Speed snapped up the UFO chain business, and a little after that – Mr Friction Facts himself.

The summary of this little journey is that over the last 5+ years – I doubt any lubricant has been as tested as paraffin, MSW / UFO wax – in all types of lab testing and field testing. Its performance benefits and limitations I believe are the most accurately known and proven of any lubricant. The entire journey re this by Friction Facts to UFO & MSW is all on the good ol interweb, and is all independent testing and data before FF was acquired by Ceramic Speed.

Friction Facts didn't just wake up and decide one day it would be a fun hobby to convince the world paraffin wax was amazing – simply the performance of paraffin and running a solid lubricant on an external part – and all the logical findings that came along with the deeper investigation after initial testing – it simply led FF down a path that ended up with UFO chains and Molten Speed Wax, and that proven journey is open to all. One can start with Friction Facts white paper on friction causing mechanisms in a chain from the Friction Facts website: http://www.friction-facts.com/media/wysiwyg/Friction_Producing_Mechanisms2.pdf

However - paraffin / MSW / UFO wax is one of the lubricants that is very sensitive to no slacking time. If run continuously on an FTT machine – after a time it will experience a sudden and continual ramp up in efficiency losses. These losses will be reset when chain is rested. It does not experience this efficiency loss increase on an FLT machine – so this does not occur on your bicycle. It also does not occur on a track bike as there is still slackening through the bottom of the drive train and all the load is through the top span.

So that is a background re FTT and FLT testing, and the journey of paraffin to UFO and MSW. Now to the other side of the case study;

Muc-Off.

Muc-Off have an FTT and FLT machine (supposedly designed by themselves and called different names although they perform exactly the same functions as FTT and FLT) and have been furiously working away on their lubricant development – apparently in-conjunction with much field testing with Team sky. They market their lubricants as having been developed initially for Team Sky before then putting them out to market for all cyclists to enjoy what Team Sky enjoy.

As such Muc-Off have released Team Sky Hydrodynamic lubricant, Nano particle lubricant, Nano Race chains, and most recently NTC chain – which is basically the same as their initial Nano Race chains but skipping the initial break in to bring a cheaper offering to the market as the original Nano Race chain is pricey indeed. *(With the NTC chain user is to break in for 4 to 6 hours at home on their ergo which is why it is cheaper than the original Nano chain….)*

As part of the launch of the new NTC chain – their launch brochure made some rather startling headline banner claims indeed.

First was that their main competitor – Ceramic Speed UFO chains – started to have a notable friction increase after just 18 minutes.

The second bombshell was that the UFO chain displayed a 10w increase in efficiency loss after just 4 hours.

Wow.

Wow indeed.

I believe there are a couple of very serious implications with such a claim. We either have the pioneer of race chains selling something for $170 that will have the consumer at around 10w higher efficiency loss by the end of an ironman bike leg - which would be quite a scandal - or we have something seriously amiss with the Muc-Off testing and marketing claims – which would be a different type of scandal.

It would either be a) Shocking if the claims re UFO chains were correct, or b) Very embarrassing if the testing and results published by Muc-Off were accidentally incorrect, or c) Something far more worrying if the testing and results published by Muc-Off were not accidentally incorrect.

At the time of the launch I put out a number of facebook posts covering the issue, and Ceramic Speed obviously took things rather seriously and did a lot of checking of their own.

The lead theory of course was that Muc-Off simply ran UFO chain, and other competitors, on the FTT machine for 4 hours straight which would give rather shocking looking results for lubricants that need slacking time, however leave lubricants that do not require slacking time looking rather impressive.

It is important to note that not all lubricants need slacking time. Some are unaffected if kept under tension, some are mildly affected, some are badly affected. If one decides to use a particular base for a lubricant that is unaffected by no slacking time, you can merrily run on an FTT machine to your hearts content.

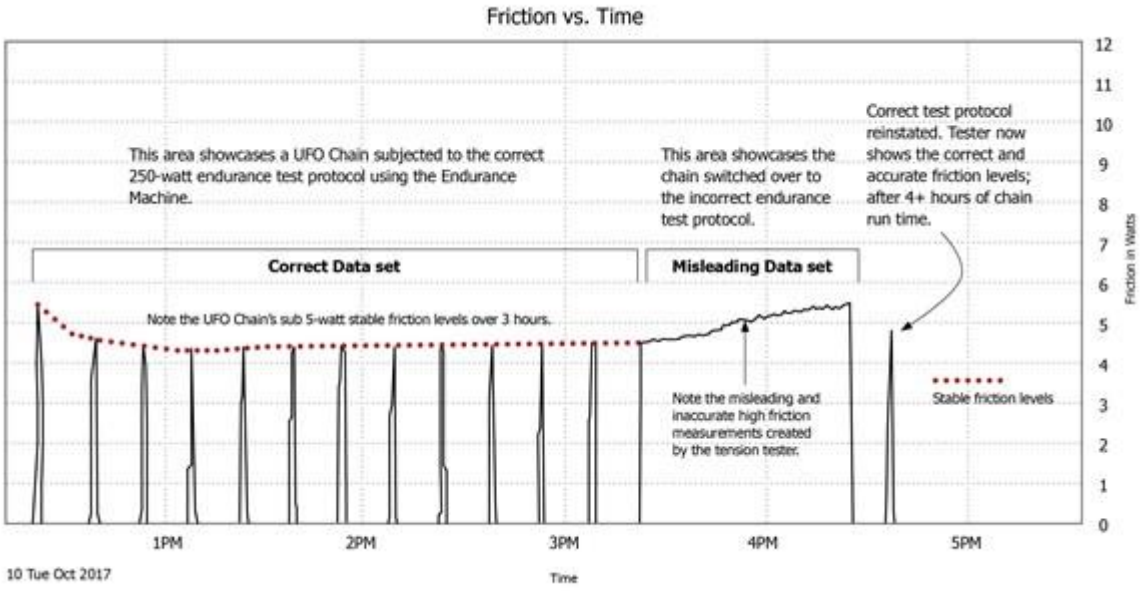
Ceramic Speed re created what they believed to be the case with the Muc-Off testing, and low and behold – were able to replicate the same results. Which is basically exactly what they knew would happen, being that Mr Friction Facts himself discovered all this to begin with, and hence why there are both FTT and FLT machines.

The Ceramic Speed Open letter response to Muc-Off testing which goes into further and better detail can be found here;

http://www.ceramicspeed.com/sport/news/news-archive/an-open-communication-on-muc-offs-claims-on-testing/

Here is an excerpt from that document;

A single CeramicSpeed UFO Racing Chain (KMC version for the sake of testing) was run continuously for a 4-hour endurance test. The first 3 hours of the test were performed properly. The 4th hour was performed incorrectly. The graph below is an actual “print screen” from the tester. It has not been altered or manipulated in any way except for the added text.



For the first three hours, the chain was run under 250W load on the Endurance Machine. At 15-minute intervals, the chain was removed from the Endurance Machine, placed onto the Full Tension Tester for a 1-minute friction measurement, and then placed back on the Endurance Machine. Note the stable, realistic, and expected behaviour of the UFO Chain. The friction levels maintain a mid 4-watt range for the first three hours of the test.

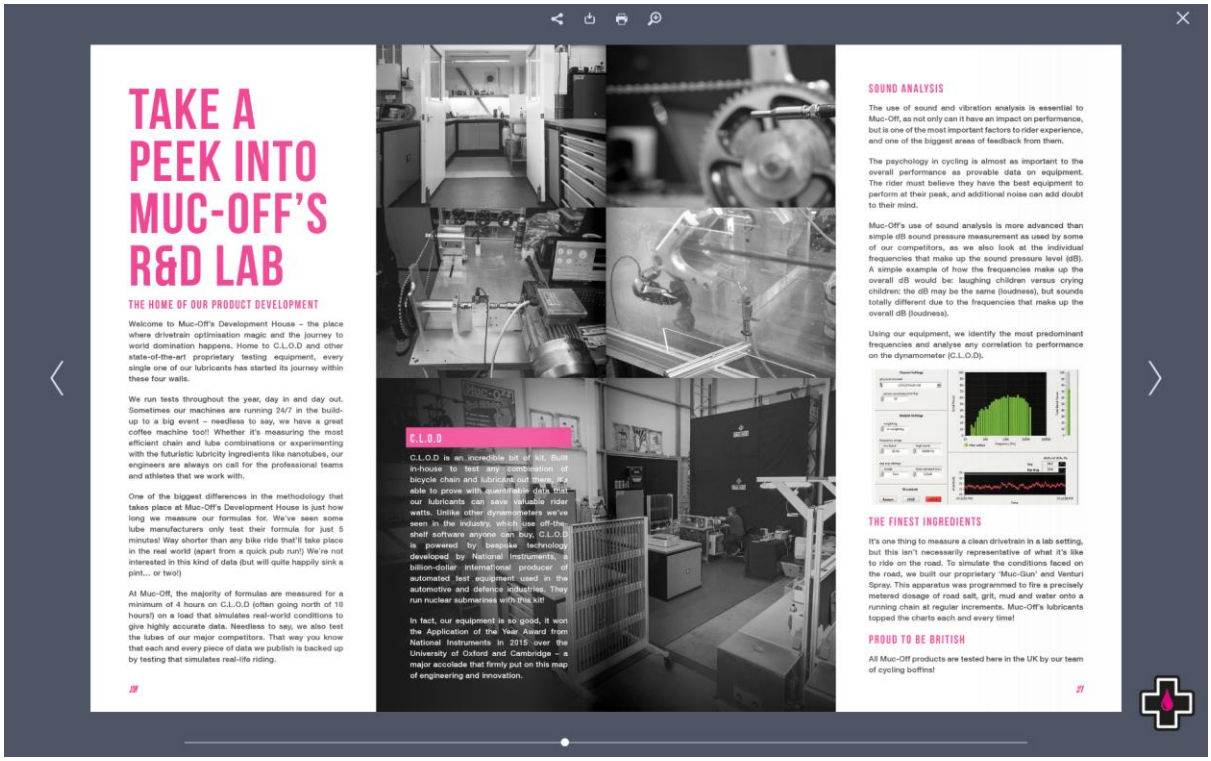
After the 3-hour correct test, the incorrect test procedure was initiated. The chain was removed from the Endurance Machine and placed on the Full Tension Tester. However, the chain was allowed to remain on the Tension Tester for one hour. Note the relatively fast increase in friction levels when the chain is on the Full Tension Tester for this long period of time. This steady increase in friction during the 4th hour is very similar to the UFO Chain friction increase seen in Muc-Off's graph.

After an hour of the incorrect procedure, the chain was removed from the Full Tension Tester and placed back on the Endurance Machine for 10 minutes, to allow the chain to slack through the rear derailleur spans, and then a final friction reading was taken on the Full Tension Tester. The final friction reading was 4.75W.

This test shows how friction measurements can incorrectly climb when a chain is run long-term on a Full Tension Tester, and how the friction almost immediately drops to original levels when the chain is taken off the tester and allowed to slack. The data from this incorrect test is similar to Muc-Off's original graph. The chain friction increased significantly during Day 1 under Full Tension, then suddenly dropped due to slacking at the end of Day 1, then the friction increased again during Day 2 under Full Tension Tester.

And from there one can also read more on endurance test protocols etc from the person who actually pioneered this wonderful world – and remember this pioneering was all done well before he was a CS employee.

A screenshot from Muc-Off NTC Launch Brochure, notice in the pics of their lab they clearly have both a Full Tension Test machine (Pic 1 on second row) and a Full Tension Test Machine (Pic 2 on second row). One must assume they know why they have both machines and how to use them. If they believed they only needed an FTT machine, they would have only invested in an FTT machine. These machines are not cheap at circa 25k usd each. For proper efficiency testing you simply must have both, which is why they invested in both. It should not be a wild assumption that the people running the lab most assuredly know why they have both and what they are doing with them.



So – that leaves us with some pretty heavy questions.

There is no way to sugar coat it or shirk away from it. The questions are;

1) Does Muc-Off, in possession of both an FTT machine and an FLT machine, with rather well paid and qualified people involved in testing and product development – **Does Muc-Off and the staff running the R&D and these machines have full awareness of why they have both an FTT and FLT machine and how to use them correctly?** Would it not be rather odd in the extreme if they didn't have a full understanding of why they have both machines and the reasons why one doesn't have just and FTT machine? Note in the brochure Muc-Off do a bit of a piece to cover their head of R&D, former Aerospace Engineer Dr Martin Matthias. One would have to believe his understanding of all things testing and R&D would far exceed mine by orders of magnitude, so If I know you cannot test chains continuously on an FTT machine…

2) Does it pass the logic test that their main competitors race chain would start to increase in friction after just 18 minutes, in a lab, **and be over 10w higher after 4 hours** – without there being some anomaly – especially when the product in question has years of independent testing data already openly available re the performance of Paraffin / MSW / UFO wax including longevity and contamination testing?

3) From the knowledge of FTT and FLT already available, and Ceramic Speeds recreation of the test results using just an FTT machine - Is it possible that Muc-Off conducted the testing just on the FTT machine by accident, not understanding why they have an FLT machine as well, and not realising that a 10w+ friction increase in 4 hours was perhaps just a tad anomalous and requiring further investigation? Instead they appear to have just ran cheering all the way to the marketing department thinking that all their Christmases have come at once?

4) Or rather worryingly – if we assume that by chance the very clever boffins in the R&D lab just happen to be fully aware as to why they have both a very expensive FTT machine AND FTT machine, is it possible that a base for their lubricants was chosen that is not affected by no slacking time? This would allow them to run long tests just on the FTT machine, and produce hard data showing how their products resoundingly smash their competitors. Note it was not only UFO that suffered from very poor looking results in the Muc-Off testing, other main competitors with known high performance such as Squirt were also shown up in a very poor light.

At the time all this was occurring, I was emailing Muc-Off with regards to this test and results, and asked if the testing was in fact conducted just on an FTT machine. I did get a reply initially that was along the lines of “oh you know you cannot really compare different testing protocols etc”.

I re-iterated again the detail in Ceramic Speeds Open letter response and requested them to confirm if the testing was done just on an FTT machine, to which I received no response. I kept emailing them every week or so for months, and have never had a response back. All of my questions, and the serious implications raised in both the above questions and the Ceramic Speed’s response could have been easily addressed in a couple of paragraphs response by Muc-Off. Instead – the sound of silence.

I have not seen them make any response to Ceramic Speed’s Open Letter in any cycling publications.

Nor have they changed the information in their NTC launch brochure.

Nor have I seen any cycling publication investigate this situation.

What is ZFC belief on the above?

The below are simply my personal opinions – I am not stating or claiming as fact anything in particular re Muc-Off testing – I am just joining the dots of information that are available in the only way that makes logical sense to me personally.

All information points very clearly to the Muc-Off testing having been done on just an FTT machine.

- I believe the answer to my question 1 is an obvious yes. It is implausible in the extreme that the very clever staff in Muc-Off's R&D lab are not fully aware of why they have an FTT machine and an FLT machine and how to use them correctly.

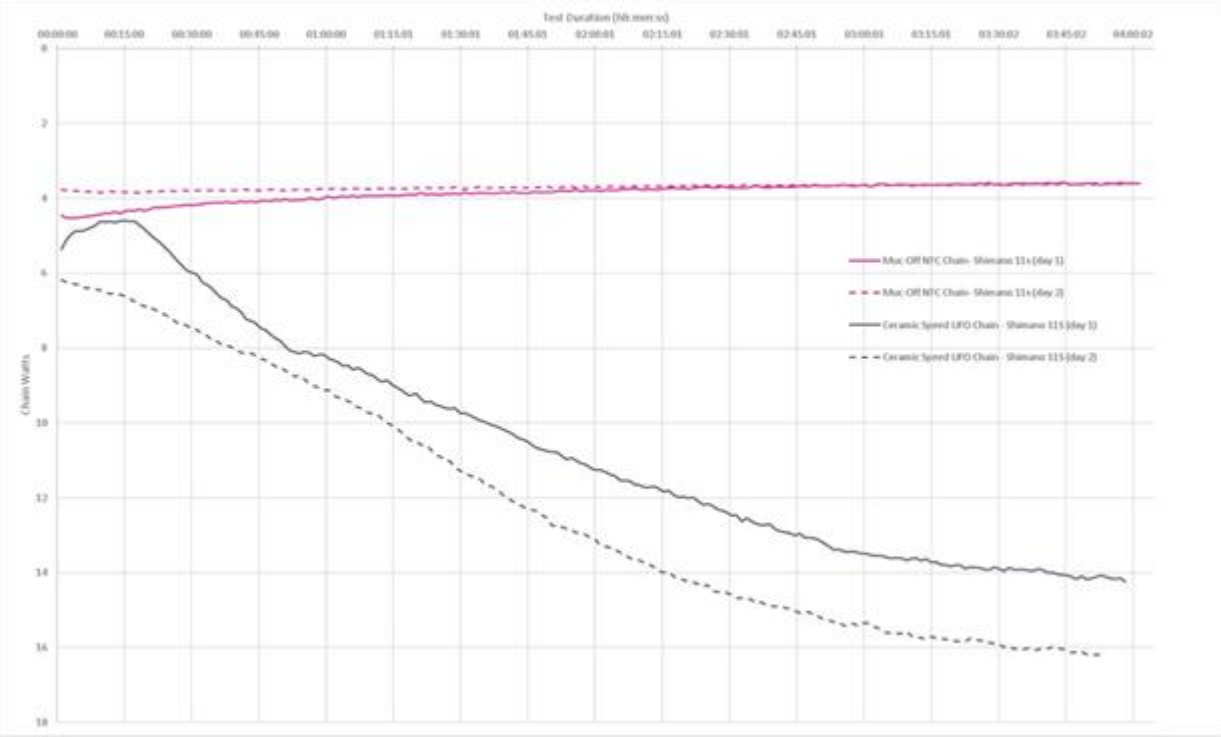
- I believe the answer to question 2 is no. It does not make any sense that even if they came across that result that they would run to the press machine to publish. Anyone with even the most rudimentary understanding of testing and lubricant performance would see those results as hugely anomalous and investigate further – especially with the years of lab and real world testing behind wax based race chains from days when this testing was independent.

- This leaves the answer to question 3 as extremely improbable in my view. It is improbable that they would incorrectly conduct the test on just an FTT machine by accident. It is even more improbable that if they did, after attaining such wildy anomalous data re UFO chain test that this would not be investigated thoroughly before running to the press. Even if by some extraordinarily strange set of circumstances and oversights they conducted the testing just on just on the FTT machine by accident – anyone in the department with greater than 3 neurons would have picked up there was an issue straight away when the results came out. It is also very concerning as highlighted in CS open letter response re **Muc-Off editing out the wax performance resetting** between days 1 and 2 of the test. Refer to the below excerpt from Ceramic Speeds Open Response. Concerning. Very very concerning – why edit this data out?

Muc-Off originally produced the "UFO chain friction vs time" graph with two days of data, Day 1 and Day 2, using the same UFO Chain for both days (see Graph 1). Note how the UFO Chain's friction levels dropped from 14+ watts down to 6 watts when the chain was removed from the Full Tension Tester after Day 1 and re-tested for the subsequent Day 2 test run.

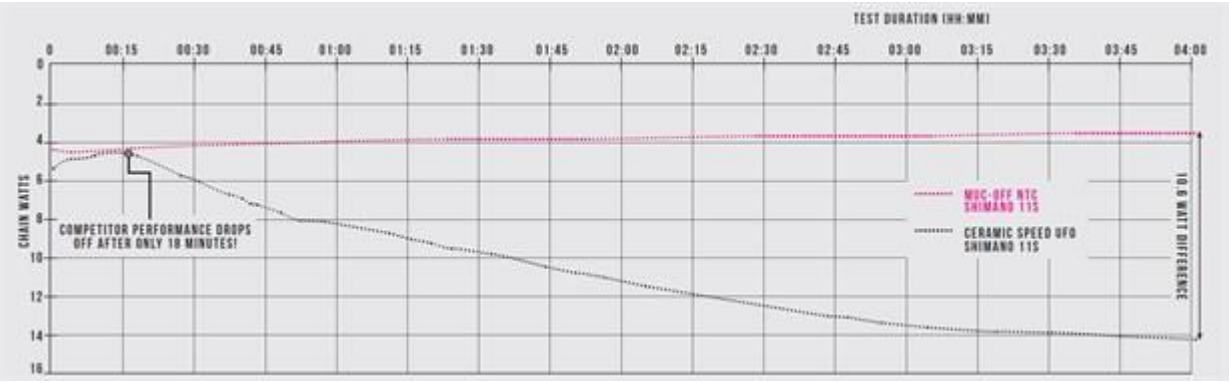
This drastic drop in the UFO Chain friction obviously begs the question; How could a chain get 8 watts faster by sitting overnight? The answer is it didn't get 8 watts faster. The chain was never a "14-watt chain" to begin with, even though the Full Tension Tester was putting out this data. The Full Tension Tester was producing incorrect and excessively high friction readings due to the long duration test. This is undoubtedly due to the 'slacking effect", and is a tell-tale sign that the Full Tension Tester was employed incorrectly for long term testing in this case.

Graph 1: Muc-Off's original graph showing a UFO Chain decreasing 8 watts overnight, between Day 1 and Day 2 testing.



Muc-Off's original graph indicates something is potentially flawed with the test due to the instantaneous drop in friction on the same UFO Chain between test runs. When the recent NTC Chain brochure was launched, the "Day 2" data containing the anomaly was removed from the graph (see Graph 2).

Graph 2: The "revised" graph as seen in the NTC Brochure. The Day 2 data was deleted for the publication of the NTC brochure.



CeramicSpeed has no way of knowing if Muc-Off is aware of the consequences of the 'slacking effect' phenomena or indeed why the graph was revised.

Regardless of that, an 8-watt immediate decrease in chain friction between test runs, on the same chain, should quickly raise eyebrows in any situation, and Muc-Off ought to have revisited their test.

And so it leaves the answer to question 4 as something I find deeply worrying. Was the testing deliberately conducted just on an FTT machine, with the base for Muc Off lubricants being deliberately selected that is not affected by no slacking time? On the surface if one wished to deliberately miss use fancy testing - this is an easy win. How many people will have read CS open letter response (or this document) to learn about FTT and FLT testing vs how many see the flashy NTC brochure and go wow – NTC is amazing and UFO is con! There has been no investigation by cycling publications into this situation. Muc-Off simply don't answer questions by unknown minnows like ZFC, nor have they needed to or bothered to respond to Ceramic Speeds response. Is it a case of Muc-Off have done something I find misleading and worrying in the extreme simply because they can and no one will ever hold them to account – they can just merrily sell away and badly muddy the waters of product testing.

I also personally find it a disappointing that no major cycling publication has delved deeper into the situation. The NTC launch was a display of extremely powerful marketing at its best with its headline act the terrible performance of their main competitor's UFO chain. This was disturbing not only to Ceramic Speed who then invested a lot of time and effort into their Open Letter Response – but I find it very disturbing that such a situation like this between two of the biggest players in the industry can make it to print and it's accuracy or validity is not questioned by any cycling journalist / tech writer? (that I know of – if you find an article where someone has tackled this issue, please send me the link).

Is it that the implications are a little too scary to tackle? No doubt Muc-Off are a significant source of advertising revenue and is this a bear no one is game enough to poke?

I am never one to sway the way of conspiracy theorists – but something is seriously amiss with this entire situation. I feel it should not be a tiny little hobby business raising highlighting the above situation and raising the above questions or feeling compelled to have to put this document together. I feel I should have been reading about the too and fro of this from proper journalists from the major publications. They have a lot more clout when seeking answers than a nobody like zfc. The details and claims and discrepancies between Muc OFF and Ceramic Speed from the NTC launch should have been straightened out by someone qualified to do so at the time.

Aside from the serious and worrying implications around this situaton, having such a situation in itself just makes more and more cyclists cynical of testing and hurts the efforts of those whom are genuinely trying to bring you a great product, or help you decide which products deserve your hard earned money.

How many readers would have seen Ceramic Speed's performance claims re UFO chains, then seen Muc-Offs claims re UFO chains, and shaken their heads in frustration not knowing who to believe? Who has the time to launch their own investigation to get to the bottom of it / read a detailed

technical document from Ceramic Speed, compare it to the claims in the NTC brochure, and try to work out whom they think is correct?

This situation should not exist – lubricant and chain testing is one area that has enough research done that an established protocol can be followed, and an apples to apples comparison made. Should a situation like this case study between Muc-Off and Ceramic Speed arise, then much more should be done by publications to get to the bottom of it;

- For their readership base
- To prevent / reduce the likelihood of such situations occurring in the future
- To assist in driving a culture whereby manufactures not only provide data to back their marketing claims, but that the data is factual from a robust or proven testing protocol.

In my view the above case study is still a situation that needs to be resolved. To me the conflicting claims and the questions behind it are just too concerning to be simply swept under the rug.

Okay – time to tie the let me come right back to the start and the main point of this document. This document is about helping to clarify that just because there is tested and published data behind performance claims unfortunately this does not mean it solves your consumer decision making if that data has come from the manufacturer and they won the test.

If it is manufacturer testing proving their product is numero uno, and yet at the same time we have other manufacturers also with test data saying theirs is numero uno – things are no clearer than if we didn't have test data to back claims. One of the manufacturers may be correct and they have genuinely brought the best product out to market, but if another manufacturer is claiming great things through either accidentally poor or nefariously poor testing – the waters are getting muddier instead of clearer.

We have had a situation where for a long time manufacturers have been able to claim whatever they like about their products performance without any accountability at all re those claims.

Now – even with what should be tangible hard data testing to back products performance, we still have situation where a manufacturer can publish whatever data they like re their products vs others without ever needing to answer any questions on the accuracy or validity of the test results they went to market with. It is still carte blanche publish whatever you like without any accountability.

This situation needs to change. Manufacturers making genuinely great products, with robust testing and data to back claims, and whom readily answer any and all questions re product testing and performance – should be highlighted as such. Manufacturers on the other end of the spectrum should also be highlighted and held to account.

Zero Friction Cycling is chipping away on this front where we can. A key goal for ZFC is to improve the quality of information on products and performance to help cyclists choose the right product purchases for them. The truly stand out products we look to add to our very select little line up.

If you have a situation where you are confused regarding two opposition manufacturers claims re performance of their products and would like some assistance in getting clarification – feel free to bring it to my attention – I can try to help with what clarifying questions / information to seek from the respective manufacturers and we can see who is open and who just provides marketing spin and then runs for the hills ☺

Lastly just for fun, here are some other quick anomalies re the case study whilst I'm here;

- On page 30 of the NTC brochure Muc-Off have their own C3 dry lube at a perplexing and impossibly low 2.9w, as well as their Bio Dry lube at 3.62w. So they have two of their normal budget dry lubes notably beating their special race NTC lube / chains – which averaged over 4w for the same test period for which the entire 43 page launch brochure is about (as shown a few pages later in brochure). Quite simply this is just bizarre. A massive fanfare launch of NTC chain as a top race chain choice, and is a rather expensive chain mind, and in the very same brochure just a few pages apart, the NTC chain is beaten by some of their budget dry lubes.

  What. The. Farout.

  It is beyond perplexing indeed that Muc-Off would publish a brochure where their budget lubes are beating their expensive race lube. I have not been able to get a response from Muc off with regards to this either (surprise!). More anomalies do not enhance the credibility of Muc-Off's testing.

- Both Muc-Off Team Sky Hydrodynamic and Nano lubes tested extremely poorly in ZFC testing. Both ate through chains at a rate that would be similar to just running sand and water. And both were HORRENDOUSLY dirty lubes. If you haven't heard the saying a clean chain is fast chain, well I can tell you if your lube is an abominable black mess and eating through the hardened steel parts of your chain at a prodigious rate, it is unlikely to be a low friction and fast chain.

  Again I wrote to Muc-Off re my test results and did they have any input re the results. I sent them full detail of protocol test brief and all lube test running sheets to date. I received no reply.

  I put out a call on social media re users experience of Muc-Off Hydrodynamic and Nano products – and the responses from users matched my testing. Anyone who had used

Hydrodynamic or Nano found the dirtiest lubricant they had ever seen and most stopped using after a couple of applications despite the large $ they paid for the lubricant.

- You can see in Ceramic Speeds testing they attain much higher friction losses for the Muc-Off's NTOC chain vs NTC chain. The NTOC chain is their higher level chain again – the NTC chain launch was for a more cost effective option of the NTOC chain – the NTC chain has less optimisation prep done vs NTOC chain.

So the NTOC chain would rank very poorly in Friction Facts original league table of the 55 lubricants they tested, and is 50%+ higher than Muc-Off Test results for NTC chain.

One of the questions I also asked Muc-Off was to confirm in writing that Team Sky do in fact use Team Sky Hydrodynamic / Nano. On the surface for a team that is rather dedicated to marginal gains, the enormous rate of wear from both Hydrodynamic and Nano seem incompatible with a low friction / high performance lubricant. Personally I find it improbable that a world tour team would run such a lubricant. I wouldn't run a lubricant with that wear rate in any race I wanted to do well in. I'm not claiming that Team Sky are not using products as marketed – it is just I am adding 1+1 and not arriving at the answer of 2.

Again I received no answer from Muc-Off.

When I was investigating all aspects of the above situation I had two rather stark response levels from the two companies involved. Ceramic Speed answered all questions in specific detail, with answers and data that added up and made sense. I even managed to get a 1 hour skype call to discuss. Muc-Off initially replied with some more marketing fluff, however as soon as I brought it back to the specific questions as outlined above, I have never heard from them again on any fronts despite repeatedly trying to contact them for months.

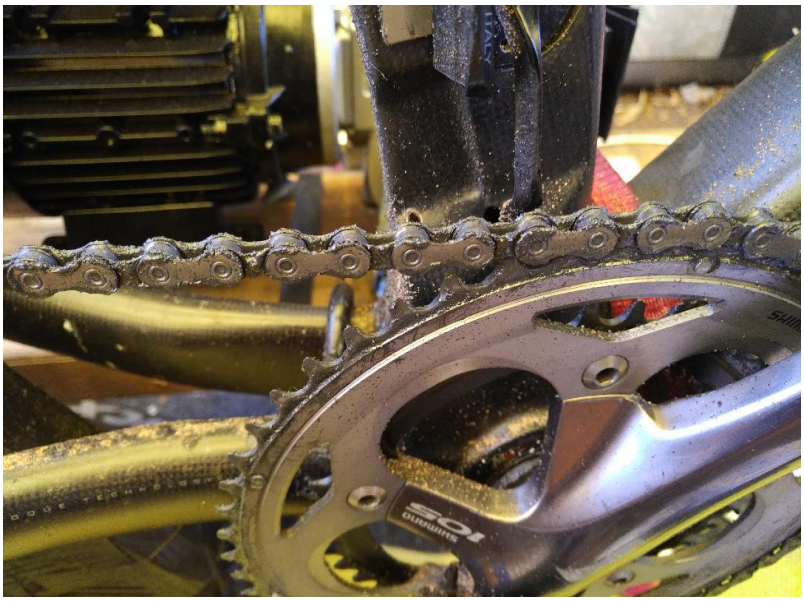
If I had to bet my house on whose test results I believed, to me we are weighing up in the one corner;

A company whose key employee pioneered testing with Friction Facts, who answered all questions, who was able to recreate the contentious results by deliberately testing incorrectly exactly as per the testing knowledge established. Or;

The company whose testing appears extremely anomalous on many fronts and they refuse to answer any specific questions with regards to the testing, or in fact - anything.

To highlight a little the difference seen between products from ZFC testing, below is picture of Molten Speed Wax chain from ZFC lubricant test. This is the chain after 6000km of testing with absolutely no cleaning. Chain wear after 6000km was 78% of the allowed 0.5% elongation wear limit for the test. The testing included a dry contamination block for 1000km, a wet contamination block for 1000km, and an extreme contamination block (a lot of water and contamination added at many points in the block). Molten Speed Wax and UFO have a lot of similarities being both based on highly refined paraffin with added PTFE and Molybdenum.

Next we have end of test for Muc-Off Nano. This test was stopped at the end of block 2 – so only 2000km vs MSW chain at 6000km. As such it also missed being subjected to the **wet contamination block** and the **Extreme contamination block**, both of which are much harder on the lubricant and chain than just the dry contamination block which is the only one Muc-Off Nano was subject too. Wear at end of test at just 2000km was 145% of the allowed 0.5% elongation leading to end of test at this point. *(Note - This equates to 9.9mm of hardened steel abraded away from friction within 2000km for Muc-Off Nano, vs 5.3mm over 6000km with much harsher contamination blocks for MSW)*. Muc-Off Nano Lube has demonstrated by far the highest wear rate of any lubricant tested to date.



A final note – prior to starting ZFC and lube testing – I can assure you I had absolutely nothing against Muc-Off – in fact I have been a long time user of their cleaning products, and always found their cleaning products to very good. I had assumed that Nano lube / Nano chain would be something I would look to add to my product selection. It has been a rather surprising journey indeed. The use of their cleaning products is now past tense until they can advise me what is happening re the lubricant testing and lubricant performance.