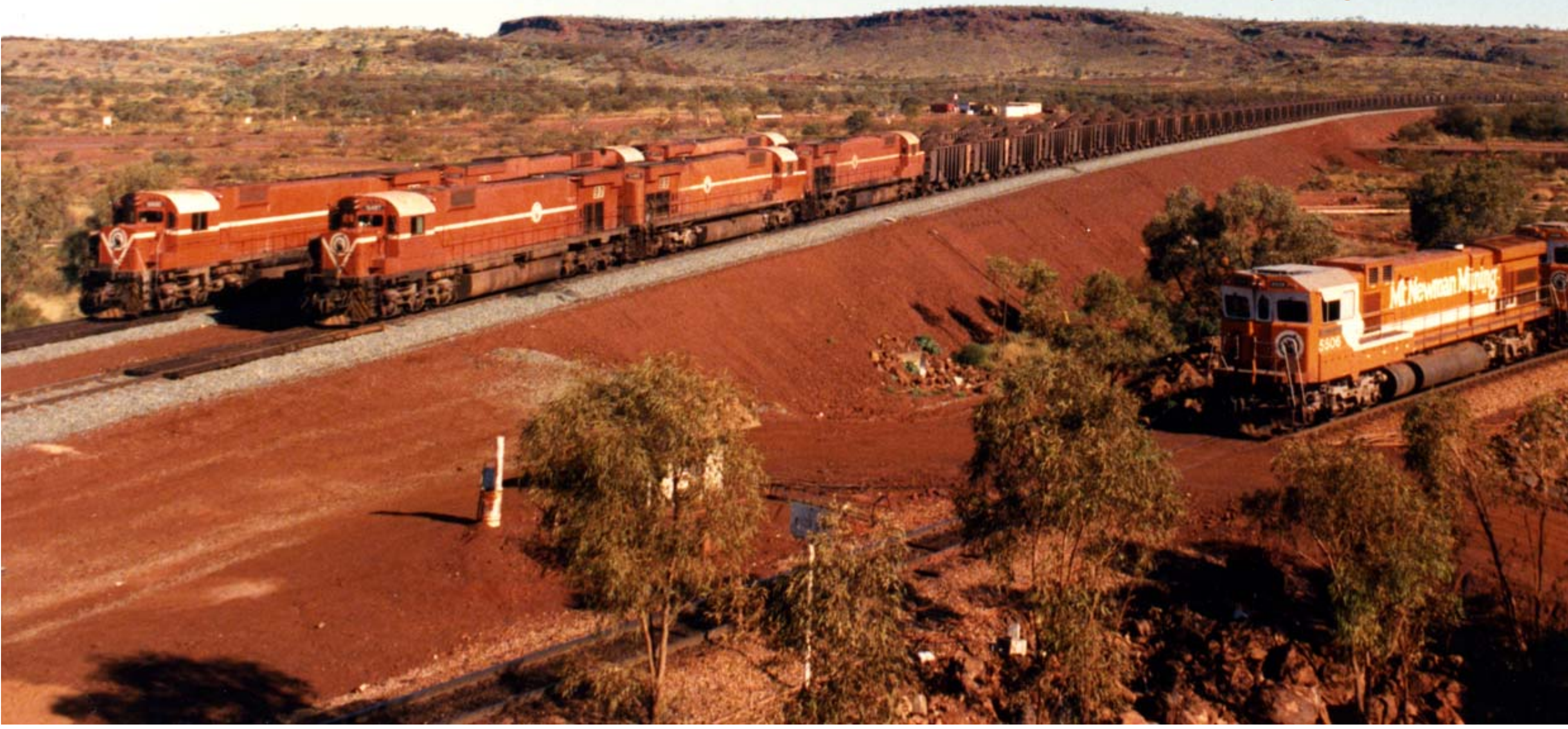
On the *Tdjilla* trail -

Tracking the world's heaviest trains

By Fergus Moffat



This account chronicles a moment in time; a loaded ore train run from the mining town of Newman to Port Hedland in 1989. The company nowadays known as BHP Billiton Iron Ore was then called Mt Newman Mining Co Pty Ltd. In a documentary movie produced to commemorate the completion of the railroad by US construction giant Bechtel Pacific Corp a worker wrote and performed a song in which he likened the new line of railway to the *Tdjilla*, or 'snake' in the local aboriginal dialect.

In 1989 the locomotive fleet was still largely ALCo although a number of the older C class Centuries had been trucked to Perth where they had 'morphed' into Goninan-GE 'Dash 7½s' and there were also four new Dash 8s – also rebuilt from Alco frames, the first to be built and operated outside of North America and the vanguard of a new motive power order in the Pilbara. And the livery was still orange and white! All empty trains ran directly to Newman. They were either loaded with Mt Whaleback high-grade or Marra-Mamba ore from an adjacent mine or the trains were split and rakes taken to either of two near-by ore bodies for loading by front-end loader. These rakes would then be returned to the Newman yard and combined into full-sized trains to be forwarded to the Port. Driver-only operation was in the future, as were fly-in/fly-out staffing, rostered 12-hour shifts, major new satellite mining operations, 6000hp AC traction, and Locotrol III technology. This, then is how it was. Join me for a ride on the *Tdjilla* Trail...

The jangling alarm clock urges me awake and, as often happens, I spend some few seconds staring at the ceiling in the darkened bedroom as I struggle to orientate myself. It is 05.30 at Newman in the northern Pilbara region of Western Australia. Today I head to Port Hedland on the return leg of a two-day return trip running iron ore trains on the Mt Newman Mining railroad.

I have allowed myself an hour and 45 minutes to shower, dress, breakfast and be out of town on our 07.15 schedule. The soft, blue night light in the hallway of the rail-crew quarters doesn't prepare me for the fluorescent glare in the lounge room as I enter and mumble greetings to other crewmen ranged around the room in easy chairs. My co-driver, Jim Ward is already up – pulling on socks and steel-capped shoes, and drinking tea. Together we walk to the nearby company mess. It is a typical high-summer morning in Newman. Crows screech their unlovely cacophony from the gum trees and at this hour the air is soft and cool. The bush flies are as active as usual but to the uninitiated there is no hint of the heat to come.

The breakfast menu this morning includes bubble and squeak (a favourite of mine) and we eat in leisurely fashion, discussing our trip up on the empty train yesterday and Collingwood's chances this afternoon. Moving out through the mess kitchen I sign for an Esky food hamper. Prepacked by catering staff and stored in the chiller, it contains sufficient food for two crew-members for 11 hours (yes, the contents are enough for much more than that!) - there is raw fruit, canned juice, cartoned milk, three choices of cold meats, salad vegetables, two loaves of bread, biscuits, fruit cake, canned fruit, desert tubs, sachets of tea and coffee (including decaf!), and various single serves of margarine, mayonnaise, tomato sauce, jam and honey.

We drive ourselves the 5km to the mine-site and board our train, lead unit 5630. It has arrived overnight as we slept and been loaded by the Newman crew working the nightshift load-out. It looks like we'll be away on time. Jim and I will share the running of the train by dividing the trip into quarters. It is normal for the loaded run from Newman to Port Hedland some 430km to the north to take about eight hours. The run is frequently made non-stop for a running time of seven hours or less, normal loaded train speed being 65km/h when powering with a maximum permissible track speed of 75km/h where appropriate when freewheeling or dynamic braking over undulating territory. The

A 240-car loaded train of Mt Whaleback iron ore departs Newman with a pair of Dash-8s in the leading position. Two or three Alcos or GEs will be providing mid-train power. Tom Winterbourne

The year is 1987. One empty and two loaded iron ore trains are lined up at Newman. The train in the foreground with three C36-7M units is reversing back to the loadout tunnel. Bob Hepburn

preferred train handling method is to utilise freewheeling where possible consistent with controlling slack action. In theory it should be possible (assuming a non-stop run, no speed restrictions or delays, and good dynamic braking) to make the trip with no more than five air brake applications although a theoretically perfect trip is, of course, seldom achievable.

It is Jim's turn to run the first sector today, and he stows his gear and slides into the right-hand seat whilst I carry out the important task of transferring some of the contents of the esky to the cab fridge. As the train has been stationary for some time since being loaded, Jim decides to carry out a brake pipe continuity test. He makes a 70kPa equalising reservoir reduction, waits until the brake pipe exhaust has ceased and pressure has settled, then turns the Locotrol Mode Selector to 'Isolate' position. This action cuts out the Remote feed valve, the device that supplies air into the brake pipe at the LRC (the Remote consist control car), and Jim waits until that fact is reported to him via a console indication whereupon he resets the Mode Selector to 'MU', arms the Remote feed valve by pressing the FV switch and pulls the brake release button. When the feed valve 'IN' light illuminates and the End-Of-Train monitor shows a brake pipe pressure increase we are satisfied and Jim puts in a call to traffic control...

"Hedland, three-zero."

"Three-zero, go ahead."

"Good morning Pop – Two road at the mine, 240 high-grade, good to go."

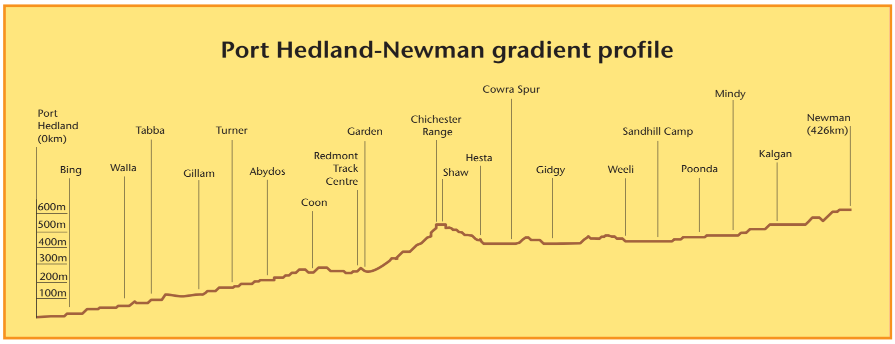
"Ah, 'morning Jim – you're right to depart, first meet's at Kalgan."

"Roger."

The exchange is necessarily brief. Traffic controller Pop Mitchell has the morning 'rush-hour' to contend with; track maintenance Hi-Rail's are calling for clearance to either 'on-track' or 'off-track', a ballast train crew is getting cranked up at the Redmont line camp hard up against the Chichester Range, an earthworks gang building a train-loading hardstand at Gidgy siding wants to foul the track. And there are other trains competing for attention. Jim sets about getting us under way while I thumb through the engine repair log.

This is a Locotrol II distributed power train with two groups of locomotives - one at the front (or 'head end') called the Lead consist and another mid-train group known as the Remote consist. Our train is 240 cars or 2,643 metres (stretched) with each car containing between 100 and 120 tonnes of ore. We have an all-GE consist on the head-end consisting of engine 5630, a CM39-8 (Dash 8), trailed by two C36-7M's (Dash 7s) and an all-Alco Remote consist comprising two MLW (M Class) units spliced with the LRC (Locomotive Remote Control car). This latter vehicle is essentially an unpowered locomotive; it can be coupled ahead of, behind, or within the Remote consist and communicates with our lead unit via a secure radio link, thereby piloting the remote units which are 'MUed' to it via the usual electrical jumper and air-hose connections.

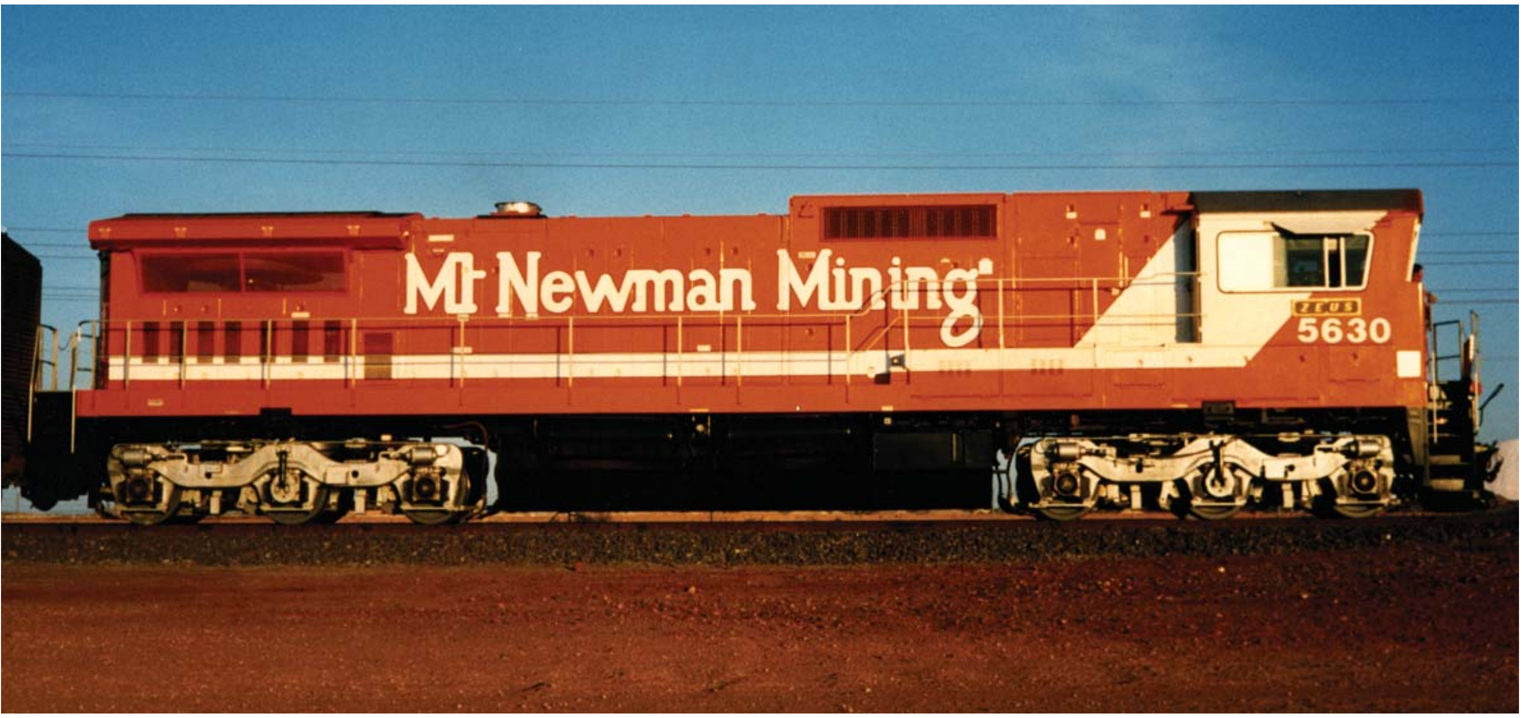
The train has been sitting on the No. 2 load-out loop, anchored by five sets of independent (locomotive) brakes and all indications show a fully-charged brake pipe. We are given brake pipe pressure readings from three points in the train; the lead unit (via the brake pipe pressure gauge on our controlling locomotive), the remote units (via the LRC and presented on the driver's Locotrol control console), and the last car (via the in-cab display for the Digitair end-of-train monitor). Our pressure



looks good at 630kPa from end-to-end and so with repeated stabs at the Independent brake Release button on the air brake console Jim gently bleeds off the locomotive brakes on the Remote consist whilst holding the head-end applied with the independent brake valve handle. With velvet smoothness some 30,000 tonnes of ore train begin to settle in against our Lead consist, and with a protesting groan from the brake blocks we also begin to move. Jim places his selector handle into "Set-Up" to create the electrical control circuits for dynamic braking and slowly moves the Independent brake handle to Release. With the whole train thus on the move we will not receive a damaging run-out of drawgear and coupler slack. Over its entire length this train has a total of some 40m of free play in the connections between the cars. This is the 'slack' referred to above. When a long train is operating over-the-road this slack can 'run in' when the train compresses (known as buff force) or it might 'run out' if the train stretches (referred to as draft force). Run-in and run-out are dynamic forces collectively known as 'slack action' and these forces have the potential to tear a train into pieces if excessive. Controlling this slack action will require the major part of our effort in running the train on this trip.

Parked at the highway grade crossing the load-out crew 'eyeball' our train as we roll out of the yard, checking for stuck or dragging brakes. In a manner befitting our entry onto the *Tdjilla* Trail, we snake out onto the main line, with light dynamic braking holding speed to the 20km/h yard limit. Once we are clear on the 'main' Jim slips the units out of dynamics and opens the throttle. The load-out crew have radioed that the train looks good and that all Remote units were revved-up in dynamic braking. At this stage, as Jim begins to advance the throttle, I walk back along our trailing units to check on how they're loading and to examine their repair books. Behind us in the distance the exhaust haze above the Remote units shows that they are also leaning into the train. With the train stretched Jim is quickly into 8 notch (full throttle) as I serve a cup of tea. On the favourable grade we accelerate to track speed and Jim carries out a running brake test to validate our automatic air brake operation and to get a 'feel' for the train. Holding power in notch 8, he pushes the automatic brake button once – and checks his air brake readings for the expected minimum brake pipe pressure reduction of 63kPa. He watches the equalising reservoir needle drop to around 570kPa and sees the Remote consist brake pipe pressure do likewise. The cab display unit for the end-of-train monitor is mounted at 'eyebrow' height above the windscreen and we both watch the digital display as it unwinds, finally settling at 567kPa – spot on! As he calls for his automatic brake application, Jim holds the independent release button depressed with his thumb. This action ensures that the automatic brake application does not occur on either the Lead or Remote locomotive consists, which are still powering. The brake pipe reduction is increased to about 110kPa and Jim waits until we can feel it taking effect before reducing the throttle to notch 6. This action is important with a train of this length and weight, and ensures the train remains stretched as he will be powering up to full throttle again after releasing the brake. (In fact the entire train is not stretched. Between a quarter and a third of the 144-car portion of the train ahead of the Remote consist is being 'pushed' by these units, so between 30 and 40 cars are bunched rather than stretched. There is a point in this portion of the train at which this 'buff' or pushing state from the Remote consist becomes a 'draft' or pulling state under the influence of the Lead consist. The forces at this point are theoretically neutral and the location is referred to as the 'node'. The node tends to float up and down the train ahead of the Remote consist depending on the driver's control actions and undulations in the track profile. Control of the node is also part of the driver's task in preventing excessive slack action.)

With distributed power operations all throttle and brake control actions made by the driver are transmitted by radio link to the LRC and replicated on the Remote units. For this reason, train air brake manipulation is via a push-button console rather than the normal drivers brake valve although the locomotive brakes on the Lead consist can still be operated using the handle. Thus, brake applications and releases occur at the Remote units (the LRC) as well as at the Lead unit. Being depleted at two points in the train, the brake pipe reduction occurs swiftly and the brake application is rapid, reducing speed relatively quickly. At around 45km/h with the reduction settled and effective Jim pulls on the automatic brake button to initiate the release. This command is also transmitted to the LRC and the brake pipe is recharged from two points. In concert with the ABDW air brake control valves on the ore cars, this provides a fast and positive brake release along the train and within a minute speed begins to increase. As we approach our maximum permitted track speed, Jim notches back on the throttle and eventually shuts off power. After waiting a few seconds for the slack to settle along the train, he moves the selector handle to again set up dynamic braking. This control action bunches the slack in the train except that contrary to running under throttle, the 30 or so cars ahead of the Remote consist are now 'hanging away' from it and are thus stretched. Again, the 'node'



The 'star' of this story: a CM39-8M (5630 *Zeus* to be exact), seen in near-new condition at Port Hedland. Fergus Moffat will float up and down from the theoretical point of neutral force by several car lengths in either direction as Jim adjusts Lead and Remote dynamic effort independently as the train negotiates undulations in the track profile. Barring any unforseen delays we will now coast or run in dynamics for the next 70km, with Jim varying dynamic effort as required (much as you would modulate the throttle when running in power) to maintain track speed. In fact today we have been given no speed restrictions for this distance and so we shall do just that, provided our 'meet' is in the clear at Kalgan. Note that whilst generally downhill, this section is definitely not level!

This will take us to the 333km location – the site of the now-closed Sandhill railroad maintenance line camp. I recall fondly the annual Sandhill 'boat races' whereby with the wet season having filled the local waterhole-cum-lake, the camp residents would challenge teams from the other three line camps (and any other foolhardy optimists!) to a series of hilarious raft races (these inevitably degenerating into competitive 4WD 'runs' through the billabong) followed after sundown with a pig-on-the-spit, a railroad spike-driving contest, and various other events perhaps better not described.

Meanwhile, at 75km/h, we bear down upon Kalgan and spot our opposition tucked safely into the 2,886m passing track. This empty train is the midnight departure from the port and the Newman-based crew aboard are almost home as they detrain to roll us by. 40 minutes later as we roll around the curve past the Quarry 6 ballast siding and the site of the old Sandhill line camp Jim eases out of dynamics, takes power and begins to advance the throttle. Ahead is a dead-straight climb at an average 0.09 per cent (1 in 1000) grade up an ancient alluvial fan to the Weeli siding location and in order to maintain track speed on this grade he will have to get our combined 18,300hp into full power as quickly as train handling considerations permit.

As we pound up this grade I listen to the muted pant of the 4-stroke V16 diesel engine thumping away behind me, and recall a past running freight trains across the mountainous central section of New Zealand's Main Trunk line. Nowadays 4,000hp electrics whine up and down the 2 per cent grades and rush across the long, tall viaducts, back then, I would sit listening to the same measured throb of the GE 7FDL prime mover installed in one of GE's successful export models, the U26C.

A blast from the locomotive horn restores reality as Jim warns some slow-moving cattle to clear the way. Our 'office' for today – one of the first four GE Dash 8 locomotives to be built and operated outside of the USA is, at 196 tonnes (432,000lb) and 3,900 gross hp, (and at this time) the largest, heaviest and most powerful diesel-electric locomotive in Australia. Its CM39-8 model designation stands for Co-Co wheel arrangement (2 bogies each with 3 powered axles), Modified from the standard US domestic design (in our case this refers simply to the fact that these units have a custom-built 'Pilbara' cab; they are otherwise identical to a fleet recently delivered to the Union Pacific Railroad), 39 hundred HP, and –8 being the now-familiar 'Dash 8' nomenclature denoting a generational evolution beyond the previous Dash 7 model. These advanced locomotives feature computer control of high-voltage electro-pneumatic equipment, alternator excitation, and auxiliary equipment such as cooling blowers and air compressor. The microprocessor control system continually monitors all operations of the locomotive, compensates for changing operating conditions and faults (e.g. varying load requirements on the diesel engine and electrical machinery), and logs and displays fault information for later analysis by repair staff and for instant presentation to the locomotive crew. So cleverly do these locomotives self-diagnose and work around their own fault events, there is little in the manner of traditional trouble-shooting for crew members to be concerned with. Even now, as we thrash along at 70km/h through a typical 40 degree Pilbara day, the computers have 'decided' that they can provide us with our required level of alternator excitation at a lesser engine speed. Even though Jim's left hand rests lightly on the throttle at 8 notch (full throttle), engine speed has backed off to the lower 7 notch throttle equivalent with no reduction in alternator output. This is one of the ways this locomotive realises its 20 per cent gain in fuel efficiency over earlier models.

Now, as we roar through Weeli, Jim is rising from his seat to hand the running to me. Taking the hot seat I glance quickly at air brake gauges and the Locotrol control console to familiarise myself with the 'state of things'. The driver's work-station on these locomotives has been designed with a balanced, 'wrap-around' console. A flat desk arrangement as had recently become fashionable in the US was not our preference, thus to the left is the familiar vertical control stand – somewhat abbreviated due to the absence of a vertically-mounted air brake valve – but incorporating the Locotrol driver's control console with its various operating switches and displays. Arranged on a 'dash panel' ahead of the driver are the load meter (presenting an indication of the current draw on the traction motors), speedometer and air brake gauges, and to the right (against the cab wall is a sloping console on which are mounted the air brake controls. These early Dash 8's are equipped with the current 26-L air brake schedule however the driver's brake valves are the W30 D/G (train) and W30IND (locomotive) – designed and manufactured by Westinghouse Australia they are a significant modification of the current 30-CDW valve designed for desk mounting. The train (automatic) and locomotive (independent) portions are physically separate and able to be mounted as required for a flexible cab layout. These MNM locomotives are the first installation of this equipment and full advantage has been taken of the design intent with the arrangement of equipment.

The automatic brake valve handle is not utilised in distributed power operations and is latched in the Release position. To accomplish radio remote control of air brakes at the LRC a set of air brake push-buttons is used and these are logically integrated into the forward control console alongside the aforementioned W30 brake valves. These push-buttons pilot the operation of solenoid-equipped air brake manifolds fitted to both the Lead unit and (via the secure radio link) the LRC – this arrangement providing a simultaneous operation of air brake functions on Lead and Remote units.

We are approaching the crest of the grade up and over the east branch of Weeli Wolli Creek and thereafter some undulating country. I reach for the Locotrol control console and spin the rotary Mode Selector switch from 'MU' (Multiple Unit operation) to the throttle '8' position. The Remote units continue to power in the '8' (full throttle) position however I now have Independent Control over them and I will begin to use that feature soon. It is axiomatic that a heavy train requires power to ascend a grade but not necessarily to descend it and that with a very long train it will be quite possible to have a portion of the train going uphill while the rest of the train is still on a down-grade or vice-versa. This is where the function of Independent Control is used. As the head-end of my train crests the grade and runs through Weeli I begin to 'notch back' on the throttle however the major part of the train is still on the upgrade and continues to require power if we are not to slow down excessively. Thus, using the Mode Selector switch I hold the Remote consist in full throttle until I judge they too are approaching the crest (now behind me) at which point I commence to throttle them back as well, one notch at a time. In this way, varying the Lead and Remote power levels as required, I traverse the undulating track over the various branches of the creek with as much control over in-train forces as possible. When the track profile permits, I will place the Mode Selector back to its 'MU' position in which the Remote consist synchronously follows all of my throttle or dynamic brake inputs.

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But now the Traffic Controller is calling us on the radio and it is not good news. The 03.00 empty ore from Port Hedland is running late and production requirements mean that its passage to the mine is being expedited. For Jim and I this means that we will not have a non-stop run home today. Indeed, we will be required to stop on the main line at Gidgy (the next siding location) to allow the empty a 'straight' run via the passing track. Apart from the inconvenience of having to bring this monster to a stand, the consequent restart means a slow uphill drag to follow. For the company there will be both a delay in our schedule and a considerable fuel penalty incurred. However, that's railroading!

We approach Gidgy on a 0.41 per cent (1 in 240) upgrade. The track levels considerably to 0.04 per cent for most of the length of the main line and then rises again at 0.33 per cent (1 in 300) through the north switch and for another 3km before cresting. We come pounding up the grade and by the time we pass the arrival signal I have reduced the throttle to 6 notch and am holding about 600amps. Using the kilometre pegs as markers I run up the 3.38km main line for 1,000m before making a minimum air brake application. Using Independent Control I hold notch 6 on the head-end and reduce the Remote consist to notch 4. As the light initial brake application begins to take effect I judge my distance to run to the roll-by marker – which is 100m before the departure signal and is my stopping point – and reduce the throttle one notch at a time. While doing this I use the Mode Selector switch to reduce power on the Remote consist, but keeping it two notches lower than the head-end as I do so. This is in deference to the fact that

By the time we draw to a stand I have the Remote's in Idle but have misjudged on the head-end and am still holding notch 2 power. To close the throttle at this point would cause a vicious and damaging electrical arc to occur... so I allow the amperage I am holding in the throttle 2 position to decay by rotating the hump-control (slow speed) knob to its Minimum position.

the lead portion of the train is now on the grade leading up to the departure signal whilst the Remote's and rear portion of the train are still on the more level section. By the time we draw to a stand I have the Remote's in Idle but have misjudged on the head-end and am still holding notch 2 power. To close the throttle at this point would cause a vicious and damaging electrical arc to occur in the high voltage control compartments on each head-end unit as the power contactors are forced open by control air pressure, so I allow the amperage I am holding in the throttle 2 position to decay by rotating the hump-control (slow speed) knob to its Minimum position. NowI can safely close the throttle and reset the hump-control to OFF. The hump-controller takes its name from its original design function, which was to provide precise control of very slow speeds during hump shunting operations. Nowadays we use it for loading trains and at any other time a controlled slow speed is required. Now I increase the brake pipe pressure reduction to 100kPa. The train will sit here on this application until we depart – the independent brake being insufficient to hold us on this gradient.

Jim and I detrain to stretch our legs and also to give the units a walk-around from ground level. Soon the empty train approaches and trundles through the turnout at 35km/h. We take up station (one either side) to roll it by. 'Tang-tang-tang-tang-tang...' the locomotive bell rings a friendly greeting as the Lead units roll past. Monotonously the 240 cars and mid-train units follow and with a quick glance to check that the EOT monitor and tail-lights are in place, Jim reports "Roll-by good, train complete" on the portable radio and we climb the ladders and prepare to move out. I reduce the independent brake to about 200kPa brake cylinder pressure and release the train brake. The basics of train air brake operation are that car brakes apply when the brake pipe pressure is reduced and they release when the pressure is restored, thus the beauty of air brake control on these 'radio' trains is in the two points of brake pipe exhaust and recharge. This makes a 240-car train easier to handle in this regard than one of our 192-car trains with head-end power only and with all brake pipe depletion and supply occurring exclusively at the lead locomotive. The ABDW control valves on each car have a feature known as Accelerated Release, which propagates by a rapid serial action along the train. From this handy attribute, as well as the brake pipe being recharged from both 'front and centre', we note within 30 seconds the Digitair cab display indicating brake pipe restoration on the last car. Now I can fully release the independent brake and open the throttle. I have the Mode Selector in 'MU' and the control console displays the throttle setting on the Remote units as I notch out. Using the appropriate membrane (touch-sensitive) switch I select the brake cylinder display to check that the Remote independent brake has released. With the Remote display I can also select equalising reservoir and brake pipe pressures as well as obtain an indication of the brake pipe charging flow rate at the LRC. We pull high amperage as we get a roll on this uphill start and I am alert for any wheel slip indication from the Remote consist. Such an indication would necessitate some independent throttle control to temporarily reduce power back there.

Some three kilometres out of Gidgy we crest the grade having managed to accelerate to 43km/h. Immediately, I begin reducing power on the Lead units whilst holding notch 8 on the Remotes. I gradually reduce the Lead units to notch 1 and as the Remote consist approaches the crest behind me I begin to back off on the power there also. Now I close the throttle and slip the Lead units into dynamic braking, holding a low initial effort. I continue to notch back gradually on the Remote units and soon I have them 'shut off' and coasting. By gently increasing the head-end dynamic braking effort I lightly bunch the front portion of the train and as we roll onto the downgrade I increase dynamic effort separately – using the selector handle to control Lead unit braking and the Mode Selector for the Remotes. Once I have full dynamic braking on both consists I move the Mode Selector from 8 position (braking) back to 'MU' for synchronous operation.

Now we descend onto the Fortescue River flood plain and traversing a wide 2,620m radius curve that provides an excellent rearward view of the train from my side we cruise past Quarry 5 and the derelict site of the one-time Cowra line camp. I get into full power as we head for the long embankment leading up to Hesta siding in the foothills of the Chichester Range at an average gradient of 0.36 per cent (1 in 280). On a comparative basis, a gradient of this magnitude may not appear as much of an obstacle, however by the time we stamp across the south switch at Hesta we are down to 25km/h. A rearward glance as we lean into the reverse curve through Hesta reveals the mighty spectacle of five high-horsepower locomotives hurling exhaust gases skyward as their prime movers pound at full throttle under full load to shove and drag this 30,000 tonne monster over the range. To me the sight is stirring and dramatic – a worthy modern-day display to rival those I recall from the bygone days of steam.

The gradient through Hesta eases significantly and provides a brief respite from the long drag. Barely the length of the train, this short let-up enables the train to accelerate to around 40km/h and is usually sufficient for the Alco's and Dash 7's in our consist to make transition – but not for long. As we leave Hesta behind we begin to climb the range proper and the train settles down to a 23km/h slog. With the grade averaging 0.50 per cent (1 in 200) against us, our Lead locomotive is some 14 m (47ft) higher in altitude than our last car. This part of the trip takes about 30 minutes and as we grind slowly around the final 600m radius reverse curves with flanges squealing, the load meter (reading 1200amps) has been in the orange band for longer than it should have. However, we have conquered the Chichesters yet again and now the

A loaded (240-car) iron ore train climbs the 1 in 50 grade through the Chichester Range in the pre-GE days. Of interest is the fact that the lead unit of this lengthy train is 14 metres higher than the last car of the consist 2.6km back down the grade. Bob Hepburn

track levels out across the top of the range through Shaw siding. As we crest the grade, I am mindful of the horsepower concentrated at our head-end – three modern GE units as against the two older Alco's located mid-train. As the front of the train comes onto the easing grade through Shaw it will tend to accelerate while the Remote units, 144 cars back, are still working hard at their balancing speed. Now, remember the 'node'? As a distributed power train crests a heavy grade at a high level of tractive effort and begins to accelerate, this nodal point begins to move back toward the Remote units (i.e. the front portion of the train begins to stretch out). Since the Remote units are still leaning into the grade and cannot attain the same rate of acceleration at this time it is quite possible that the node might move behind them. This is undesirable since the drawbar pull of the Lead consist is added to that of the Remote consist with the result that an excessive draft force might be imposed upon those cars immediately trailing the Remote consist. If such a force should prove unsustainable then a draw gear yoke or a coupler knuckle will break and the train will part and be disabled. For this reason, as we come through Shaw I have reduced power on the Lead units to throttle 6 whilst holding full throttle at the Remotes.

Our journey is now half-completed and I hand the train back to Jim. He has made tea and occupies the driver's seat having just completed his meal. He now has the responsibility of running the train over what I consider to be the most interesting and challenging part of the journey – the 100km from this summit down and across undulating country to the 120km peg where I shall again 'take the reins'. Immediately ahead is a short, sharp descent at 1.5 per cent (1 in 75) for about 5km. Thereafter, the descent eases but overall we will lose some 300m in altitude over these 100km and will run in dynamic brake for 90 per cent of it. But now Jim has our Lead units in dynamic braking as we drop 'over the top' and goes to Independent Motoring on the Remotes, holding notch 6 power for a short while before notching off and applying dynamic braking there as well. The operation of the Remote consist is accomplished by using all of the skills any train driver must apply – that is, by exercising judgement in throttle and brake operation, by detailed knowledge of the physical characteristics of the track ahead (and behind!) at all times (known as 'road knowledge'), and by understanding train dynamics and the tractive effort characteristics of the motive power. Handling a distributed power train smoothly means knowing how far back your Remote units are and where they are at all times relative to the Lead units and with respect to the track profile at any given location.

By now Jim has full dynamics on both Lead and Remote consists but as more of the train comes onto the down-grade speed continues to increase and he is obliged to make a supplementary air brake application. The descent from the summit is sinuous and in cutting for much of the distance. Under these circumstances the Lead and Remote consists can lose radio continuity – a condition known as 'Communication Interrupt'. With this in mind, Jim has gone to 'Independent Control' and has placed the Mode Selector into 8th braking position to lock in full dynamic braking at the Remotes. He is glancing frequently at the Control Console – alert for a 'Comm Int' indication. Should this occur, Jim knows the Remote units will remain in dynamic braking until the system can re-establish continuity. With a total brake pipe reduction of around 100kPa and about ¾ dynamic brake effort our huge train slides down the northern face of the Chichester Range and through Garden siding with the dynamic cooling fans at full song. A work extra with empty ballast cars is in the passing track and its crew give us the 'once-over' and report that we "look good and have two good dynamics on the Remotes". Apart from visual inspections by train crews 'in the hole', all track maintenance and other personnel who are near a passing train will observe it and communicate with either the locomotive or the traffic controller if necessary. In addition, no effort has been spared in providing the technology to monitor train status en-route. Every siding has a dragging equipment detector outside each mainline facing switch and there are four hot bearing/hot wheel detectors ranged along the length of the route. These devices are designed to sound an alarm in the CTC office when any exception is identified. The hot box/hot wheel installations make an infra-red scan of each passing train for overheated axle roller bearings or dragging brakes and send an alert to the traffic controller as well as a radio tone locally to the passing train if anything is detected. In this case the driver will already be in the process of stopping the train by the time the traffic controller calls to provide the car number, axle number, and side (east or west rail). Counting down, a crew member can then proceed to the exact car and carry out an inspection. At other times, a train can suffer a burst or parted brake pipe hose-bag or any one of a number of alarm conditions on the Remote units. All such occurrences cause considerable delay as a crew member must walk back to look for and inspect the problem. Such an expedition is no fun when it's 46 degrees in the shade, you're carrying a spare brake pipe hose-bag in one hand and a monkey wrench and portable radio in the other, and there's 47 bush flies sitting on your face. Then again, there is often a nearby Hi-Rail vehicle travelling on the access road and they will always come to the scene and assist.

The advice from the crew in the passing track is well-received since we will have no direct indication if one of our Remote units decides to go back to Idle at any time. To properly handle his dynamic and air braking Jim needs to have a feel for whether he is getting total or part of the dynamic braking called for at the Remote units.

At the 197km area, and with speed reduced to around 55km/h, Jim releases his air brake application. We roll down over Coonarrie Creek and another brake application is required at the 191km peg to check our progress. As we round the curve at the 177km peg and approach Coon siding there is a good view back along the train showing it draped like some extreme roller coaster over four separate gradients that serves to illustrate the challenge of running these trains. We roll across undulating country to the Yule River bridge then power up for the climb up the 155km bank. At the 145km peg Jim is again in dynamic braking as we drop down toward Abydos siding. Presently, we pass the site of the old Yandee line camp, closed after being accidentally burnt to the ground following a kitchen fire, and are approaching Turner siding. This location was once a passing track but nowadays is a single-ended, switch-locked spur used by track maintenance machines. It's on a steep little pinch of track, 0.60per cent (1 in 160) when the average around here is nearer 0.2 per cent, however with five good dynamics Jim has things well in hand when he hands back to me for the final 120km to the port. Ahead is a 25km/h speed restriction due to re-railing on the Turner River bridge. 3km before the commencement I have the train in full dynamic braking at 75km/h. With 2,000m to run I make a minimum brake pipe reduction and watch the Digitair display drop by 7kPa increments to 557kPa. The brake pipe quickly equalises and I follow with a further small reduction. The Digitair display drops again and stabilises at 500kPa – a total 120kPa reduction. Slowly, as energy is dissipated, our speed drops until, at 40km/h, I make the release. As this occurs our speed continues to reduce and the extended range dynamic braking on our Dash 8 lead unit assists considerably in controlling the train as we run over the slow order.

Our journey continues without incident over gently undulating country as we descend across the coastal plain towards the port. The gradient averages 0.25 per cent (1 in 400), but several short, sharp descents of 0.47 per cent (1 in 210), 0.53 per cent (1 in 190), 0.80 per cent (1 in 125), and 0.56 per cent (1 in 180) ensure I remain attentive. The general train handling strategy is to freewheel where possible over this territory, however, our 2,600m length requires (more often than not) a touch of power here or an easing of dynamic braking there on either the Lead or Remote consist to ensure there are no excessive accelerations within the train as constant gradient variations affect our progress. The smallest such variations are amplified in their effect by the sheer mass and kinetic energy of the train.

At night-time the lights of Port Hedland and the Nelson Point rail yard are visible from 70km away, but as we near our destination in the early afternoon we are 30km out before we are able to identify such landmarks as the nearby salt stockpile shining brilliantly against the blue sky and our company's towering crusher buildings. On a high tide, one can clearly discern the towering white superstructure of a giant ore carrier alongside the wharf – appearing to be floating on land.

At track speed we curve through Bing, the last siding on the very outskirts of South Hedland, still with dynamic brake fans humming. Even full dynamics will not be sufficient to slow us down for the Goldsworthy diamond so I make a minimum reduction at the 16km peg and settle back to see how she runs. Despite the fact that ore trains are usually of common length they do not always weigh the same. Add to this the possibility of an idling or dead unit (or units), the pronounced effect of cross-winds, and the presence of temporary speed restrictions at various locations and you have enough variables to require some modifications to one's train handling actions on a daily basis. There is an almost subconscious intellectual process of discernment called 'judgement' that is an indispensable part of any good locomotive drivers' repertoire of skills. When I talk to trainees about this subject, I put it like this... "Judgement in train handling is a process by which we calculate distance to run versus present velocity and rate-of-change of velocity to initiate throttle and brake control actions sufficiently in advance such as to have the desired effect when required". This may be somewhat verbose but my point is usually made. I am now striving to display good judgement as I make the second part of the split reduction and attempt to bring our speed down to 30km/h at a point 200m from the diamond before releasing. We clunk over the Goldsworthy Mining Ltd. railroad at the regulation 20km/h and I switch to channel 3 and call the Yard...

"Hedland Tower, three-zero over the diamond, two hundred and forty high-grade, serial number two-one-eight-seven."

Back comes the response...

"Three zero, g'day, clear onto 53 road – make the break, engines to the shops".

From this exchange we can expect the Yardman to meet us and split the train immediately ahead of the Remote consist, following which we shall cut off our Lead consist and run the units into the Locomotive Service Shops.

Journey's end. We roll sedately into the Port yard reception area, acknowledging the wave from the car examiners as they 'roll us in'. I pull down to the port end of our allotted road and with dynamic braking on the head-end and notch 1 power on the Remotes, come to a stand on a light brake application. This action bunches the train ahead of the Remote consist and will permit the Yardman to lift the uncoupling lever. The tower asks us to "leave the air in it", so I make a 120kPa brake pipe reduction, move the Mode Selector to 'Isolate' and wait to see the Remote feed valve 'Out' indication. When the brake pipe reduction is complete, Jim lifts the brake pipe angle cock behind our units. The Yardman has done likewise at the front of the Remotes and I can now unlink the system without dumping the air on the lead portion of the train. The locomotives though, go into Emergency when I do this and I am required to reset the Lead unit brake valve before we can proceed. The Yardman is presently calling us to 'ease away' one car length, which I do. As Jim pulls the uncoupling lever behind our trailing unit I can see a shunt locomotive waiting for us to clear so it can couple on and move these 144 cars to the car dumper.

Finally, with Jim in the trailing cab we move off to the Service Shop where we select a vacant road and spot ourselves beneath the sand towers. We clean up the cab and climb down laden with 'esky' and gear. The locomotives have spent approximately 60 per cent of this trip in dynamic brake and will have each consumed about 6,500 litres of fuel for the round trip. Already, a shop crew is clambering over and around the consist. They will be serviced, checked and made ready to do it all over again later this evening, and a shunt crew will soon bring in the Remote consist for similar attention. Jim and I walk across to the Yard Office to sign off. We have safely delivered another 26,000 tonnes of ore for export, using some $30million worth of locomotives and rolling stock. And we too will hit the *Tdjilla* Trail again tomorrow.

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Fergus Moffat is a locomotive driver who lives in Western Australia. This is his first article for Railway Digest.