



QUALLION



**>450wh/kg Li/CFx Technology with Low
Temperature Capability at -70°C**

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Powering Life.

Key Business Metrics:



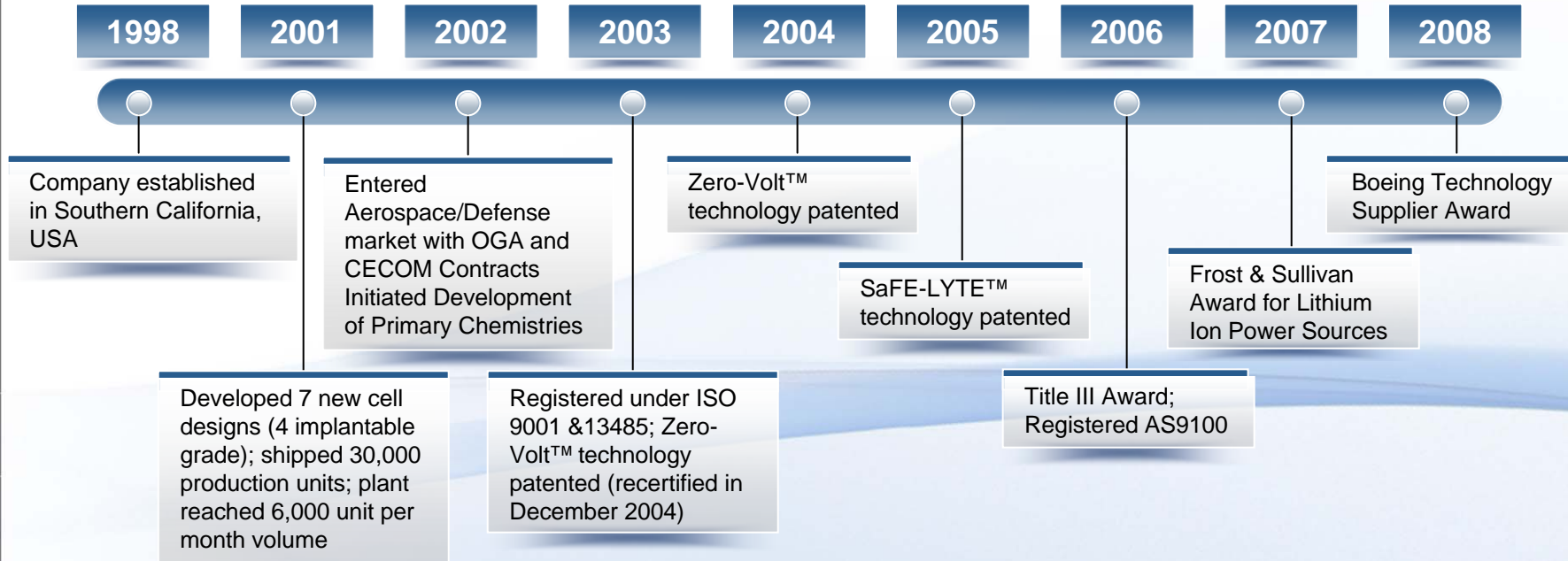
- Diversified across medical, military, vehicle and aerospace markets, 104 employees. More than 60,000 cells produced annually
- Quallion is fiscally sound with cash reserves and profitable. Quallion is not reliant on the external credit markets for expanding production
- Unique knowledge of Li ion chemistry as technology is rooted in Material science
- Active large Li ion battery programs include: USG Title III, Aircraft Retrofit, NASA Orion program (new space shuttle), Blackhawk Helicopter Retrofit, APUs for HMMWV, UAVs, Launcher Vehicle Batteries, Satellite Systems, USAF X-51 Scramjet



- In-house battery electronics design capability
- 5year/\$40M United States Military contract to establish 30 year supply of materials and cells for satellite and military applications
- Strong Li ion battery IP Position with over 60 chemistry, cell and battery patents issued and numerous patents pending
- Operations contained within 52,000 sq ft production facility in Los Angeles, CA, with an option to expand to 200,000 sq ft of contiguous manufacturing space
- Certifications include ISO 9001:2000, AS9100B, and ISO 13485:2003

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Company Milestones



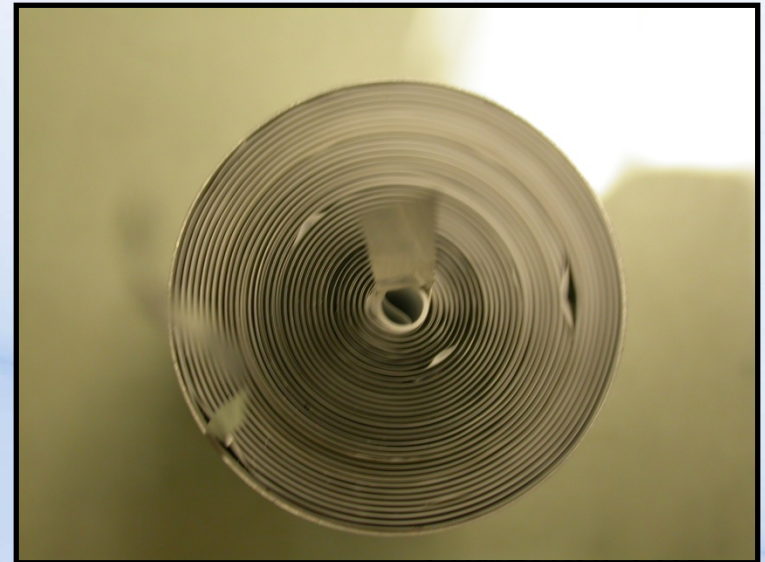
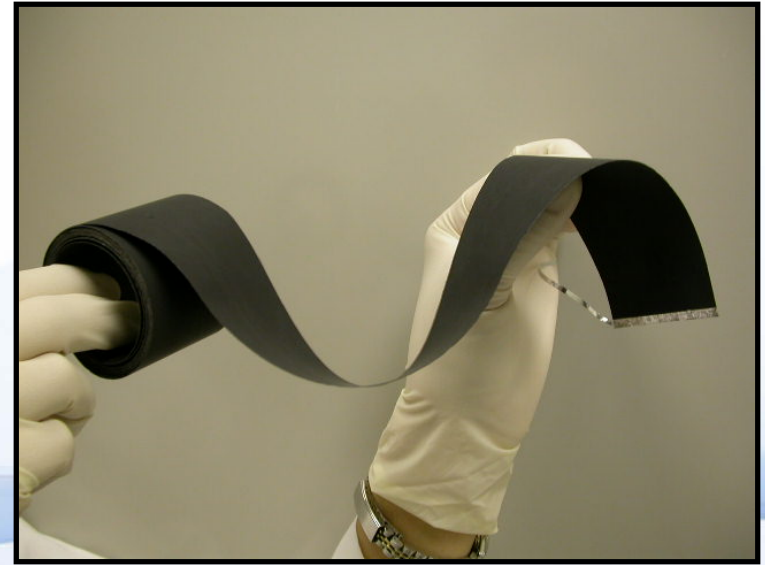
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Y2004: Proof of Concept $>500\text{wh/kg}$ Li/CFx Cell (D-size, Aluminum Can)

- Thin film coating to create flexible electrodes that can be easily wound into a jellyroll.
- The high surface wound jellyroll design enables high power discharge of the cells.

ISSUE

Safety was concerned because of large exothermic reaction during high rate and high temperature discharge

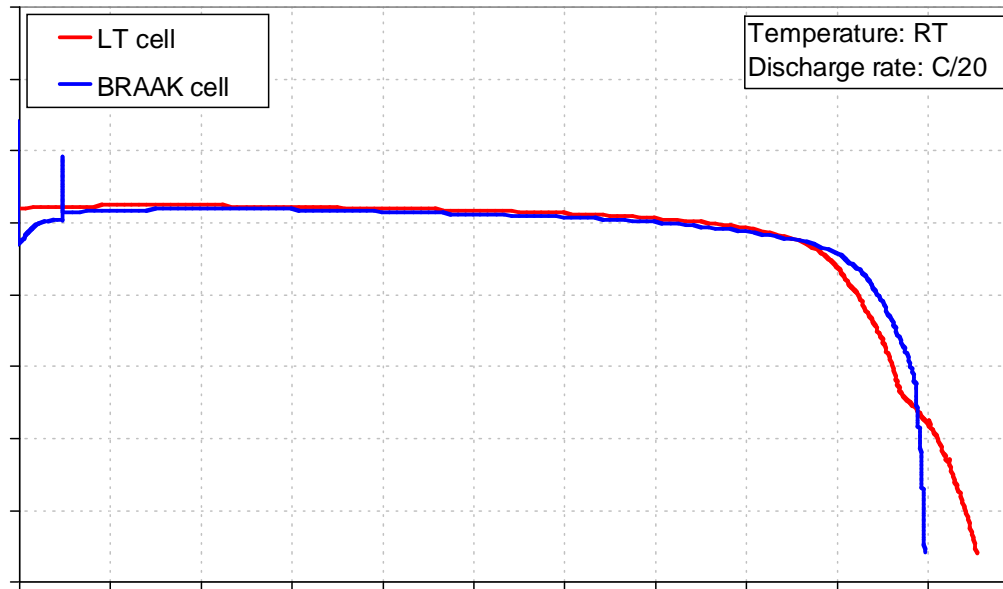


Y2007: Small Cell Approach with Advanced Safety and Low Temperature Capability

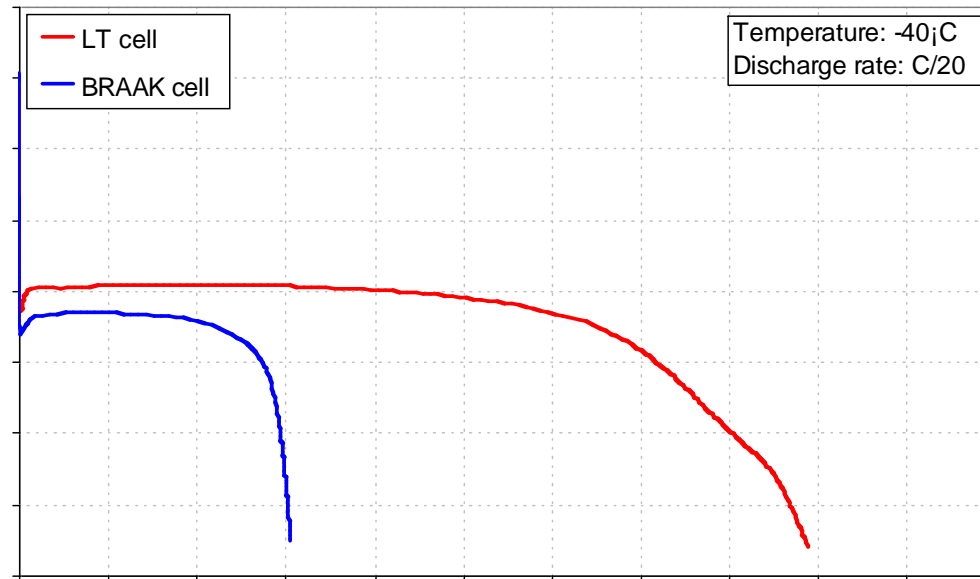
	Base line cell	Prototype (C-HE)	Base line cell	Prototype (AAK-LT)
	C-size		AA-size	
Chemistry	Li/CFx			
Nominal Volatge (V)	3			
Nominal Capacity (mAh)	5000	6500	2500	
Dimension (dimameter x height)	D26mm, H50.5mm		D14.5mm, H50.5mm	
Weight (g)	42	42	16	16
Energy density (Wh/kg)	357	464	468	468
Typical operating rate (C-rate)	<C/20		<C/5	
Typical operatiogng temperature (.C)	-40C to +85C			-70C to +85C

- Quallion is developing the Half-5590 pack with Li/CFx AA-size cells. The pack has 15Ah, 12V with 2.3lb.

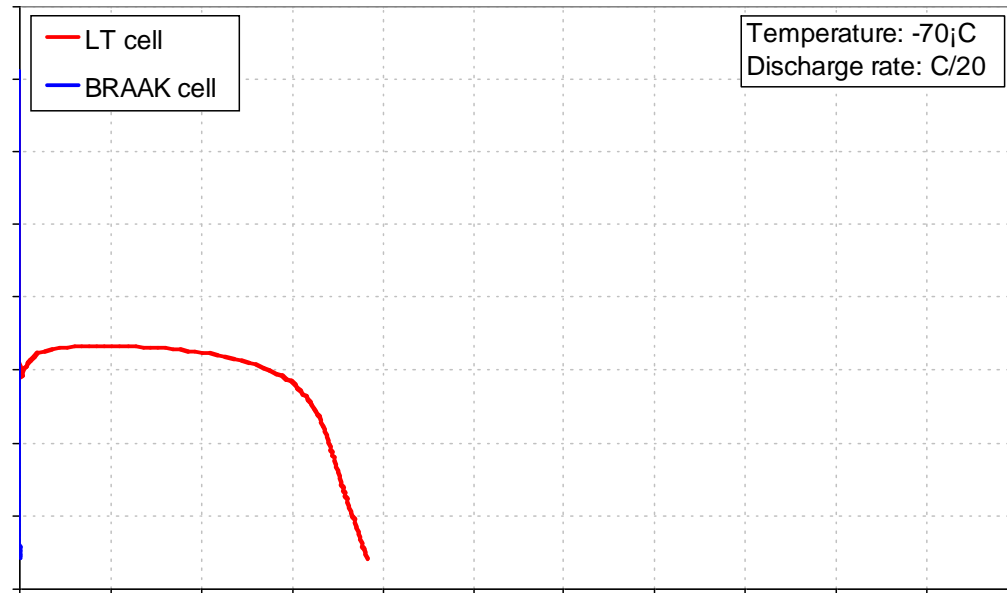
Comparison of SOA Li/CFx AA cell and Quallion low temperature AA cell (NASA application) Room temperature discharge characteristic



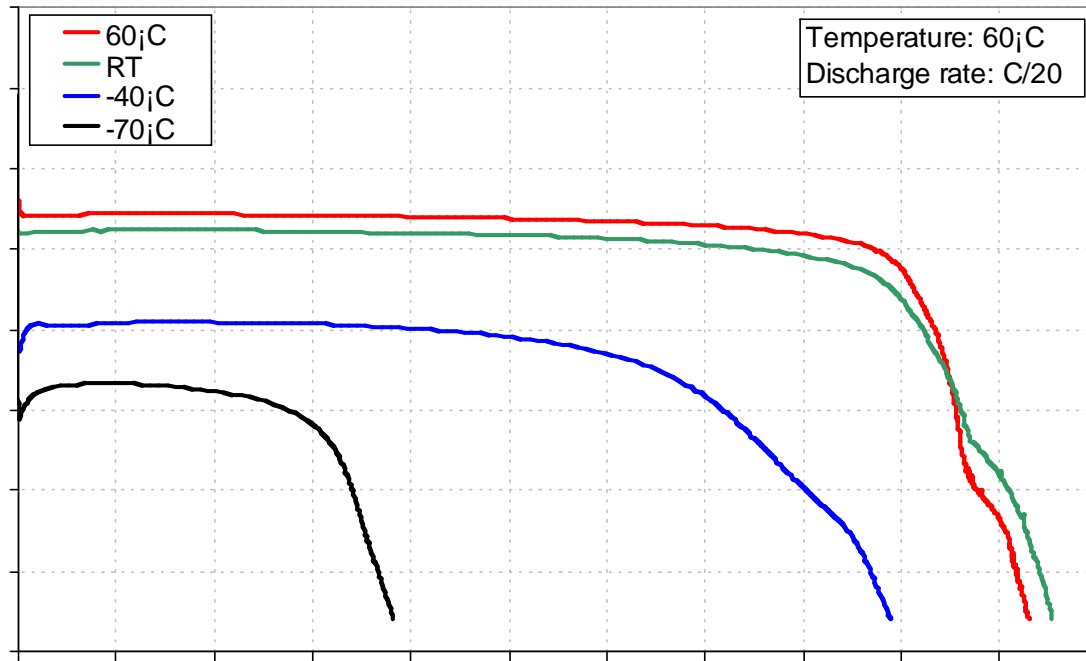
Comparison of SOA Li/CFx AA cell and Quallion low temperature AA cell -40 C temperature discharge characteristic



Comparison of SOA Li/CFx AA cell and Quallion low temperature AA cell for NASA application -70C temperature discharge characteristic

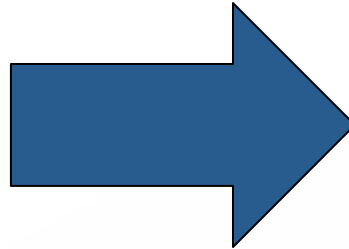


Quallion low temperature LI/CFx AA cell performance -NASA application-



SINGARS to JTRS Radio Transition

LEGACY SYSTEMS



JTRS Program: Produce a family of interoperable, affordable software defined radios to provide, secure, wireless, networking capabilities for Joint services.



- SINGARS (over 250,000 units produced)
- ASIP
- Falcon
- MBITR
- ATCS

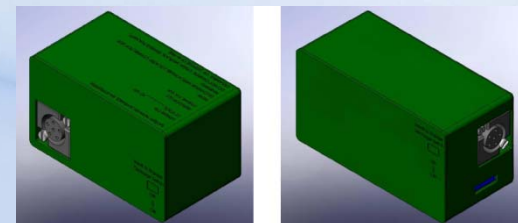
- HMS (Handheld & Manpack Systems)
- GMR (Ground Mobile Radios)
- AMF (Airborne Maritime)

Li/SO2 BA-5590

95% market saturation against primary and rechargeable solutions

Reduced envelope, lighter weight with same mission profile

Quallion Li/CFx Half-5590



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Quallion Half BA pack with unique wide temperature Li/CFx chemistry

- Small cell approach (AA-size)
- -40 to 71°C Operational
 - *Quallion Medical Li/CFx cell is capable 150 degree C Autoclave*
- 85°C Storage Capable
- C/20 to C/3 Discharge Capability
- The Half BA pack with 15Ah, 12V and 2.3lb

Cell Design

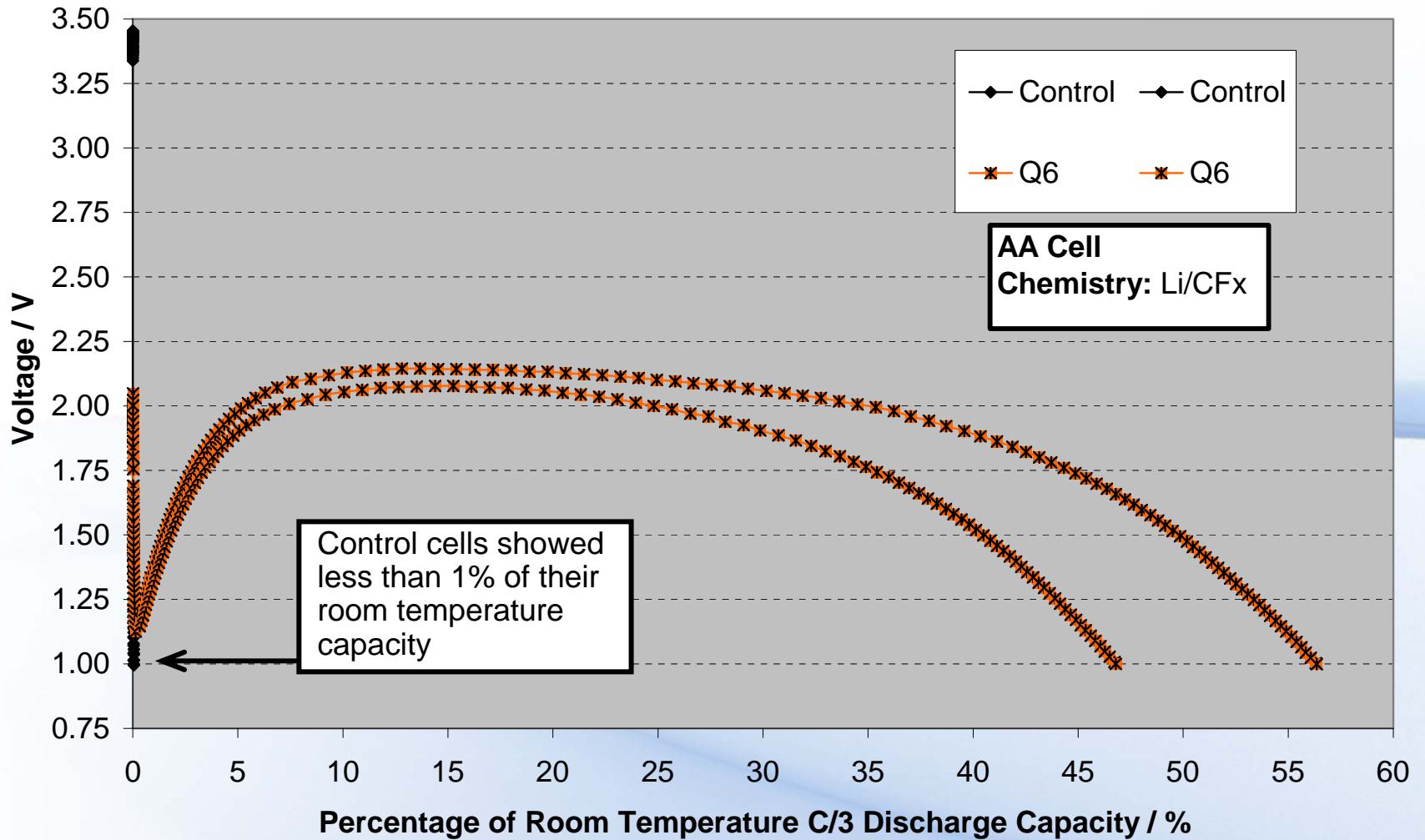
Quallion Wide Temperature Primary Battery with 966 Wh/L Capability

Cell type	Li/CFx AA
Nominal Voltage	3V
Nominal Capacity	2.5Ah
Standard Discharge Current	2.5mA
Weight	16g
Electrolyte	Quallion Low Temperature electrolyte

NOTE: D (D34.2 xH61.5mm) size Li/CFx cell with 15Ah has 798 Wh/L energy density. The 2.5Ah AA (D14x H50.5mm) size Li/CFx has 20% larger energy density than 15Ah D size Li/CFx.

C/3 Discharge Curves at -40°C

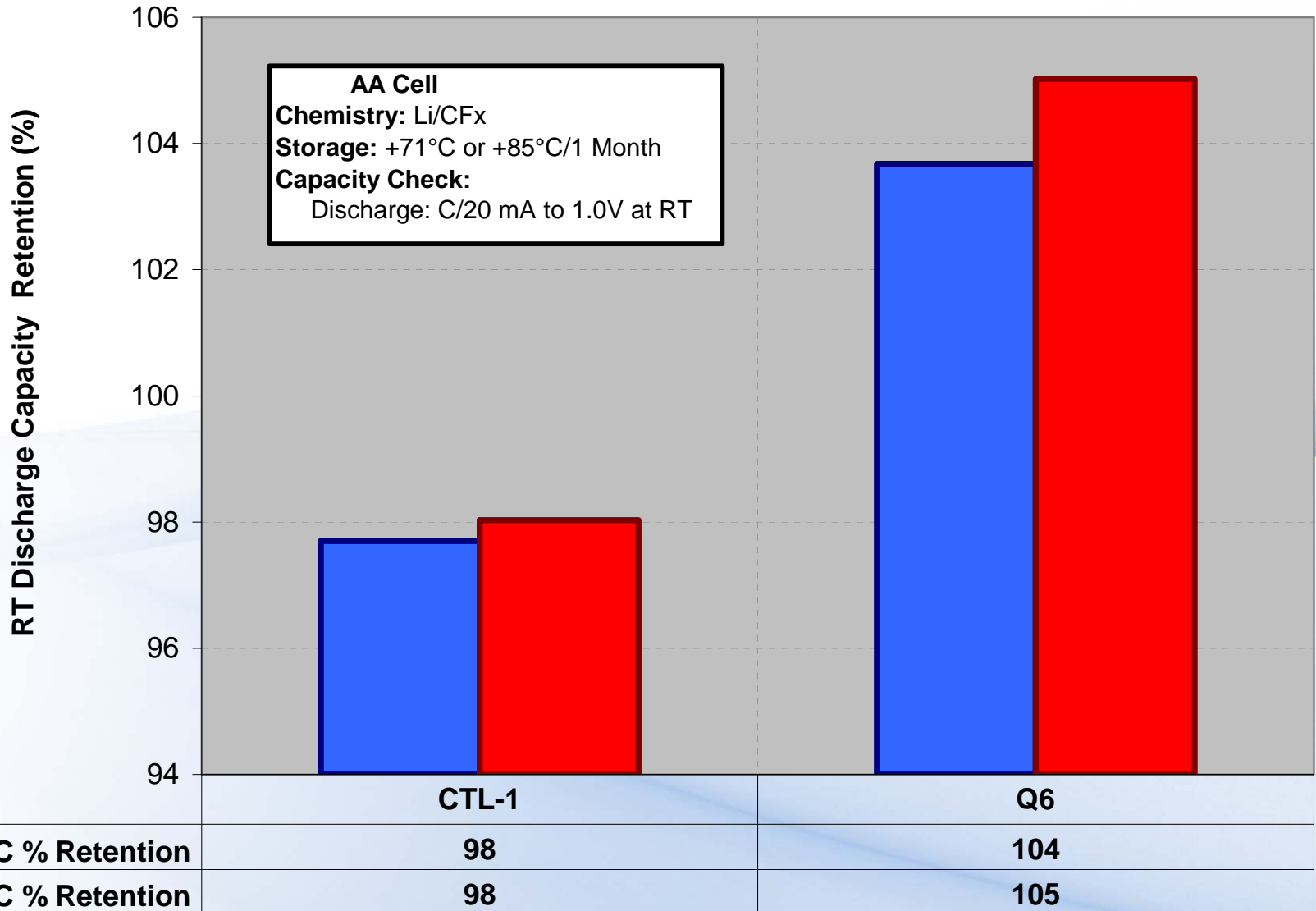
C/3 Discharge at -40°C for Tested Electrolytes



Discharge : C/20A to 1.0 V at -40°C

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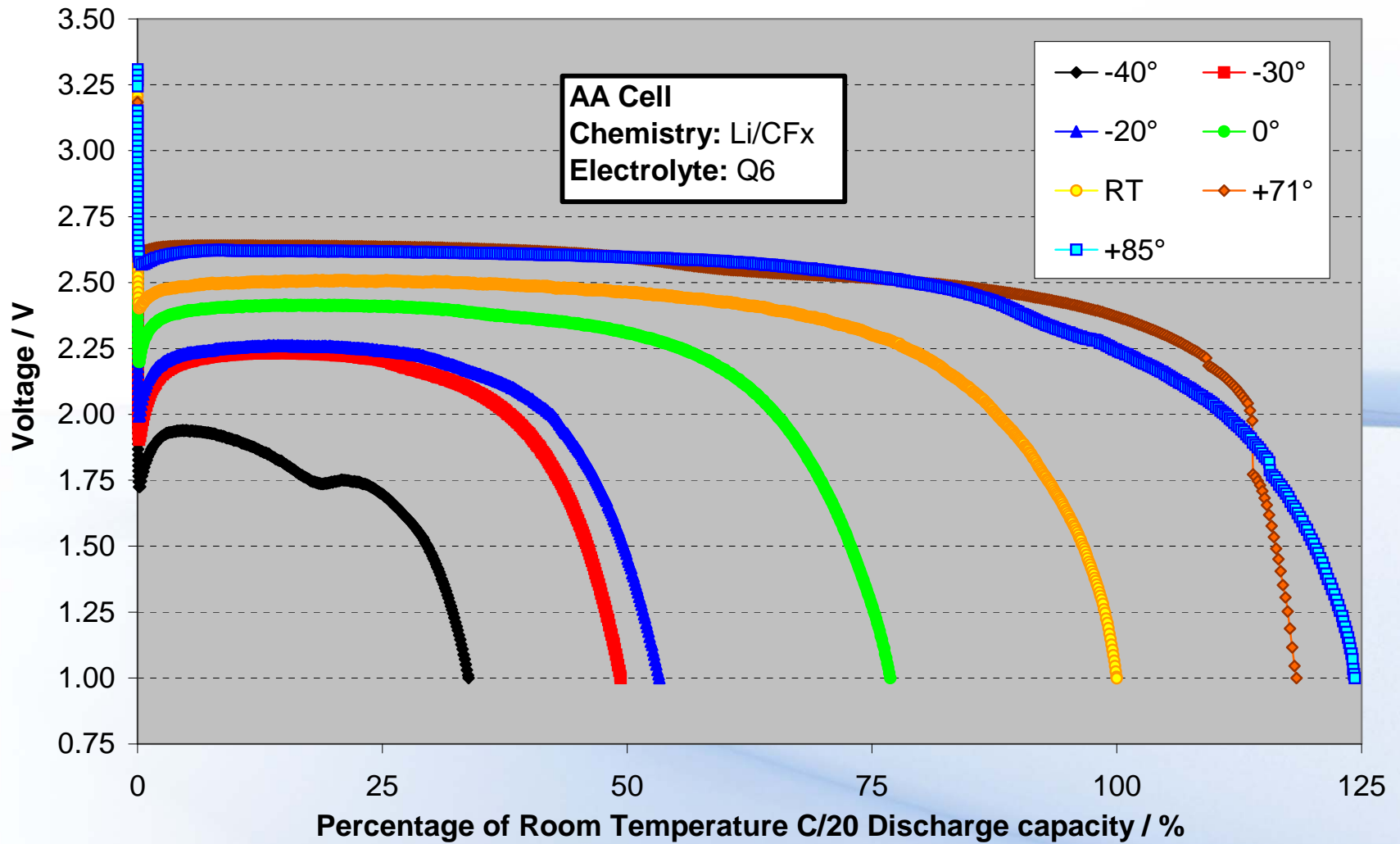
Capacity Retention After 1 Month +71° or +85°C Temperature Storage



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C/20 Discharge Rate Data of Q6-AA Cell

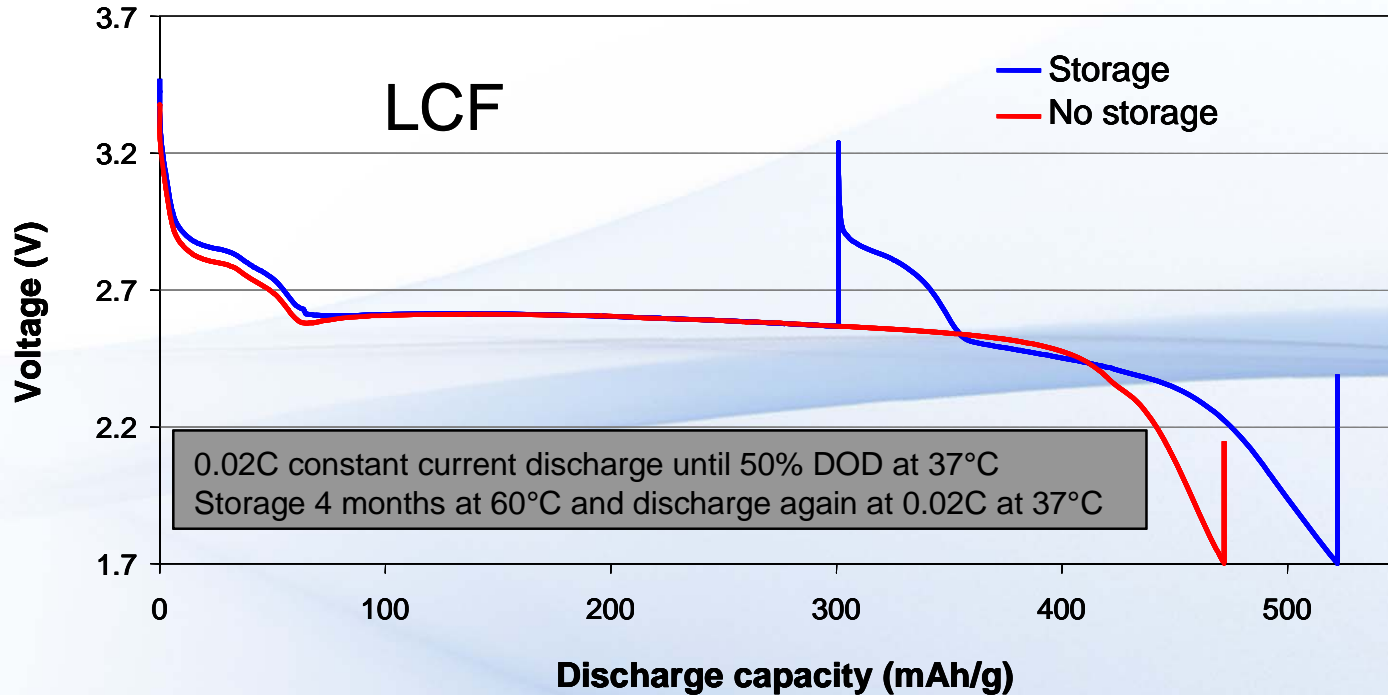
C/20 Discharge at Various Temperature



Discharge : C/20A to 1.0 V at -40°, -30°, -20°, 0°, RT, +71°, & +85°C

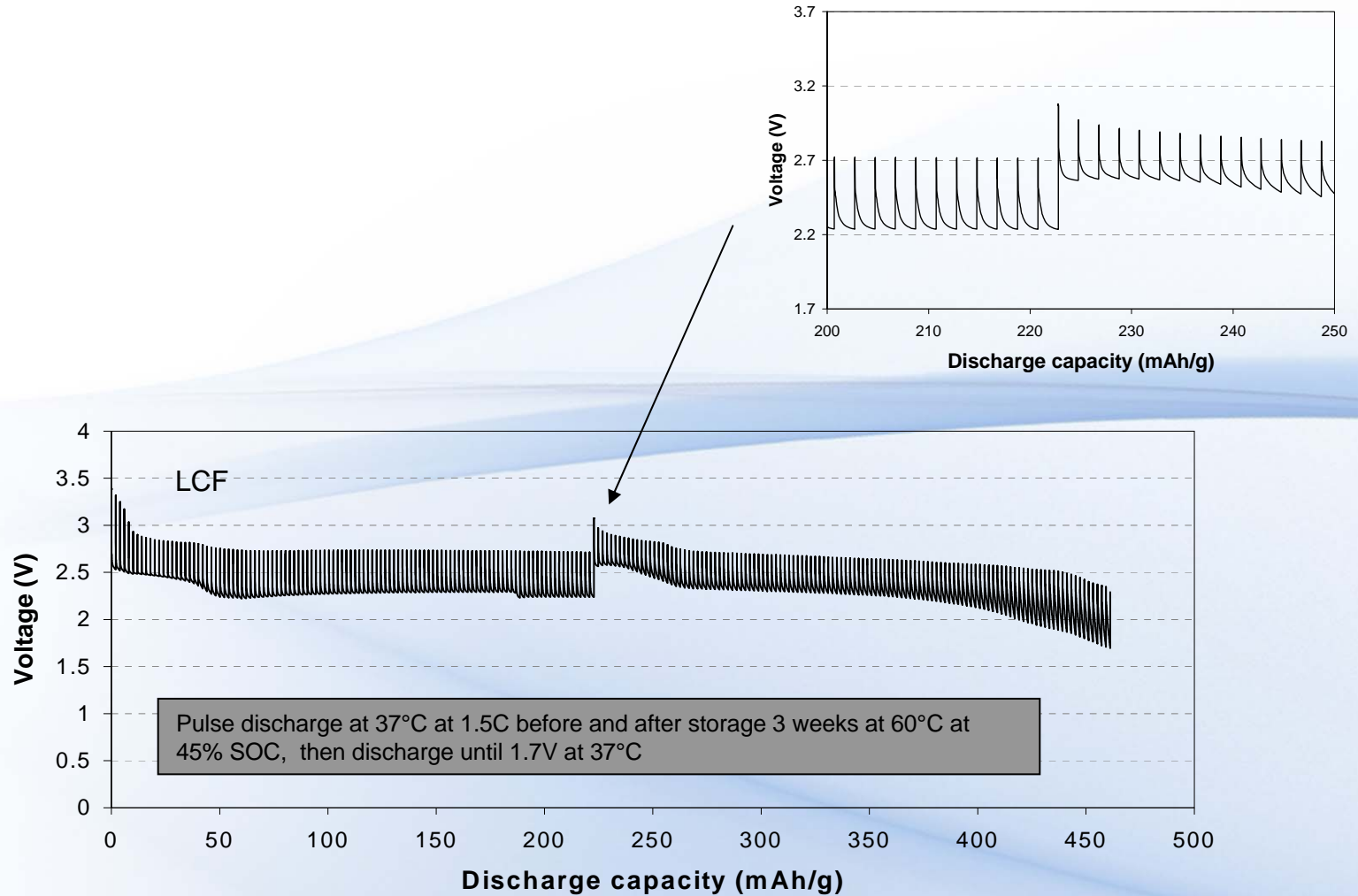
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LCF Technology: Discharge Curve after 4 months Storage

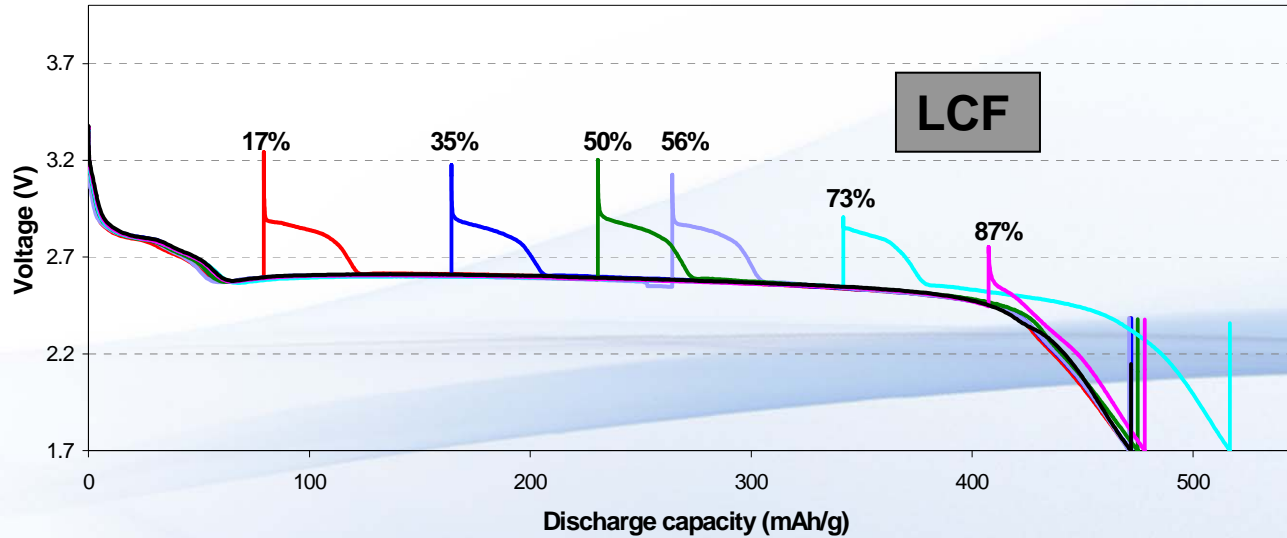


Note: After storage, the cell again showed LVO discharge curve at initial discharge period. This proved that LVO was charged during storage by CFx which has higher OCV. Stored cell and Non-stored cell showed comparable discharge capacity. This indicates that LVO did not accelerate self discharge of the cell.

LCF Technology: No voltage Delay after 60 degree C, 3 weeks at SOC 45% Storage



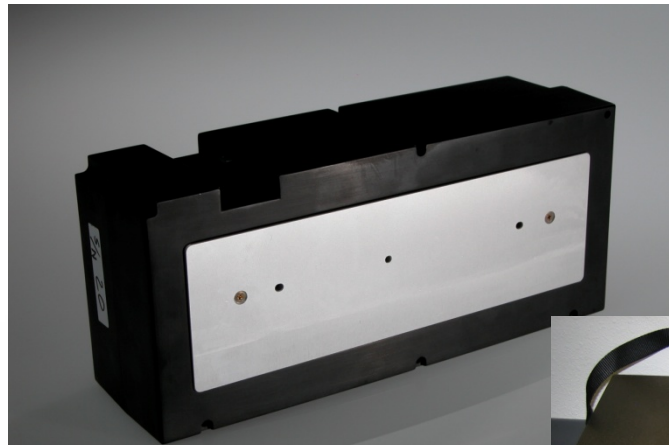
LCF: Discharge Curve after Storage at Various DOD



0.02C Constant current discharge with 3 weeks storage at different DOD then until 1.7V, 37°C

Quallion Li/CFx Summary

- Improved Low temperature performance of Li/CFx cells through low temperature electrolyte formulation
- Removed voltage delay issue by Quallion unique LCF technology
- The half BA pack with 15Ah, 12V and 2.3lb



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