

Structural Monitoring Systems PLC (ASX: SMN)

Company Update | March 2016

We have clearance, clarence. Roger, roger. What's our vector, victor ?

In December 2015, Structural Monitoring Systems' (SMN) Comparative Vacuum Monitoring (CVM) technology became the **first and only approved technology in the world** for monitoring aircraft cracking and related structural fatigue. SMN claimed a position within the aviation industry as the leader in structural health monitoring.

Forget all that stuff about thrust and drag, lift and gravity; an aeroplane flies because of money !

This milestone was critical as it enhanced the potential acceptance of CVM into commercial maintenance programs and Delta and SMS indicated that they plan to continue to lead the industry in this endeavour.

In February 2016, SMS also entered into a world-first military helicopter in-flight pilot programme with an unnamed sovereign defence force. The ultimate aim of the programme is to have CVM sensors applied to a fleet of military Apache AH-64 attack helicopters, following an initial pilot programme, which is currently underway. The programme compliments the on-going Sikorsky helicopter programme, confirming that SMS is well placed to take advantage of structural health monitoring in both the military and civilian rotorcraft industries.

Highlights

- **Boeing/FAA approval of CVM Technology:** Global Alternative Means of Compliance ("AMOC") status was granted by Boeing/FAA in late December 2015.
- **World-leading inaugural helicopter programme:** Installation and testing of newly designed CVM sensors on specifically constructed test specimens currently underway.
- **Apache in-flight pilot programme:** Commencement of in-flight pilot programme, installing and testing CVM sensors on two Apache helicopters.
- **Strategic placement to prominent Australian institutional funds management group:** \$3.7m raised through placement of 2,642,857 shares at \$1.40 per share to \$1bn funds management group and Drake Private Investments.
- **Solidification as industry leader:** Subsequent approvals within the aviation industry will be fast tracked, further increasing barriers to entry.



Recent visit of SMN Directors to Delta in Atlanta

March 2016

GICS Sector	Tech, Hardware & Equip
Shares on Issue (m)*	101,798,032
Share Price (\$)	1.53
52 Week High/Low	1.98 / 0.34
Market Cap (\$m)	155
Cash (\$m)*	4.2
Debt (\$m)	-



DIRECTORS

Toby Chandler	Managing Director
David Veitch	Non-Exec Director
Andrew Chilcott	Non-Exec Director
Michael Reveley	Exec Director

MAJOR SHAREHOLDERS

Drake Private Investments LLC	20.77%
AEM Corp	5.80%
Mclarty Family Trust	5.61%
Toby Chandler	4.64%
ABN Amro Clearing Sydney Nominees Pty Ltd	3.53%
Total	40.35%

FINANCIALS

	FY15	FY14	FY13
EBITDA (\$m)	-0.93	-0.75	-0.91
EPS (¢)	-0.01	-0.01	-0.01
P/B	250.2	N/A	274.5

MAC EQUITY PARTNERS

Bryant Mclarty, *Managing Director*

bmclarty@macequity.com.au

Josh Chadwick, *Analyst*

jchadwick@macequity.com.au

A defining year for structural monitoring systems

2016 will prove to be a pivotal year for SMS, as the company looks to capitalise on the recent Boeing/FAA approval by signing binding licensing agreements with the biggest airlines and aircraft manufacturers in the world.

Commercial Approval for CVM Technology

A meeting of SMS, Boeing and the FAA in December 2015, confirmed that SMS CVM technology was to be granted the Statement of Compliance with Airworthiness Standards through the FAA Form 8100-9.

This documentary milestone confirms Global Alternative Means of Compliance (“AMOC”) status for CVM technology. Commercial approval of CVM technology signals a turning point in the history and direction of SMS. SMS can now confidently turn its attention to securing licensing agreements with both airlines and aircraft manufacturers. It is anticipated that current dialogue with a number of significant industry participants will materialise into binding licensing agreements within the near future.

As alluded to in the recent conference call on 27th November 2015, current management, having achieved a number of important milestones since 2011, understand that to create further value for shareholders, leading industry figures who specialise in commercialisation and marketing within the airline industry will need to be elected to the board. This will be an important transition for the company as it moves from a technology commercialisation stage to the full commercial roll out, marketing and sale of CVM technology.

Strategic Placement to Funds Management Group

Having been granted the all-important commercial approval for CVM technology, SMS took the strategic opportunity to complete a \$3.7m placement

when directly approached by a highly prominent Australian institutional funds management group wanting a position in SMS. With the participation of long time investor Drake Private Investments, capital was raised at \$1.40, with a 3:4 three-year option at a \$2.25 strike price. SMS has made it clear that the funds will be used solely for potential strategic purposes, and to provide a material level of readily available liquidity. The funds will not be used to meet the day-to-day operational requirements of the company; these costs are already funded by a revenue neutral to revenue positive burn rate. It bodes well for current shareholders, that a \$1bn management fund is willing to invest in SMS for the long-term at \$1.40. It is a credit to management’s ability to have a prestigious fund take shares at a minimal discount to the 10-day volume weighted average share price.

Solidification as Industry Leader

SMS has now received approval from Boeing and the FAA, principally through the in-flight programme that was conducted with Delta Airlines. SMS management has developed a very close working relationship with both Boeing and Delta Airlines. These relationships are incredibly valuable to SMS shareholders, principally because discussions surrounding licensing agreements are likely already taking place. Secondly, because the commercial approval and close working relationships, strengthens barriers to entry into the aviation health monitoring industry. Prospective health monitoring companies will find it very difficult to compete with SMS, because of their significant first mover advantage, reinforced by commercial approval and developed relationships with a number of airlines and airline manufacturers.

About the company

Structural Monitoring Systems (‘SMS’) is an Australian holding company that has spent almost two decades developing its patented CVMTM technology used to detect and monitor metal fatigue. The technology, now commercially approved, has very strong earnings potential as the key to cost-savings and increased asset utilisation in markets that rely heavily on structural integrity maintenance, ranging from aviation to infrastructure. The company’s main operations are in the aerospace market where the value of cost savings and increased utilisation are anticipated to be the greatest.



Rotorcraft applications

World Leading Sikorsky Helicopter Programme

In May 2015, the Company signed a non-disclosure agreement with The Sikorsky Aircraft Corporation (“Sikorsky”), a pre-eminent helicopter OEM, to allow for a validation program for CVM to address health and usage monitoring on rotor-aircraft. To date rotorcraft “health” monitoring has primarily focused on vibration monitoring of mechanical drivetrain components. SMS, Sikorsky and Sandia Laboratories have collaborated to select a “hotspot” application on a Sikorsky rotorcraft. The team has worked together to design and manufacture a sensor to monitor fatigue cracking in the “hotspot” area.

The FAA Airworthiness Assurance Centre within Sandia Laboratories, under the direction of Dr Dennis Roach has now installed the newly designed CVM sensors on specifically constructed test specimens. Monitoring of both crack promulgation and durability of the sensor is currently underway.

Dr Dennis Roach commented: “This important programme is intended to begin the key process of incorporating on-board structural health monitoring sensors into routine use on rotorcraft.”

On completion of the programme, sufficient data and installation methods should be available to include CVM technology into rotorcraft OEM Standard Practice Manuals or modifications of Service Bulletins. SMS will then be in a position to take commercial advantage of the rotorcraft structural health monitoring industry, by entering into binding licensing agreements with defence forces around the world and rotorcraft manufacturers.

Apache In-flight Pilot Programme

SMS has partnered with one of the worlds sovereign defence forces to install a specialised sensor on military Apache AH-64 attack helicopters.

Providing support to the programme is SMS manufacturing/engineering partners, Aerodyne Electronics Manufacturing Corporation (AEM). AEM has developed a highly innovative sensor design to monitor the hard to reach 90-degree application area. The pilot programme is anticipated to be completed within 8-12 weeks (starting the beginning of March), upon which time CVM sensors will then be installed across an entire fleet of Apache AH-64 attack helicopters.

The “hotspot” area being tested has a very frequent inspection requirement involving considerable man-hours and an intrusive dismantling process to gain access for visual inspection. The ultimate objective of the fleet wide application of CVM technology is to monitor this known “hotspot” area remotely via the use of CVM sensors. Given that there are over 2,000 Apache AH-64 helicopters in operation around the world, SMS’ technology has the ability to dramatically reduce the cost and time involved in mandatory inspection, as well as increasing asset life.

Together with the Sikorsky programme, the Apache in-flight pilot programme provides SMS with an ideal platform in which to install, assess and progress the expanded use of CVM technology within the rotorcraft industry. The Company’s significant first mover advantage in both military and civilian applications confirms that SMS is ideally placed to benefit from the commercialisation and acceptance of CVM technology within the burgeoning rotorcraft industry.

Apache AH-64 helicopter



Market size and best guess revenue model.

This section attempts to unlock the underlying potential of CVM within the aviation industry, by estimating the savings the technology can provide for aircraft operators. SMS is in the enviable position of being able to select the most desired revenue model that will best suit the company when contracting with aircraft manufacturers and airlines.

Aircraft Manufacturers

Having been awarded commercial approval from Boeing/FAA, SMS can now begin to contract with manufacturers to use sensors in the design and building of new aircraft. Unlike the model we describe for airlines, which captures a percentage of cost savings, the benefit for a manufacturer materialises in the increase in saleable value of an aircraft with CVM sensors pre-installed. The revenue model used for aircraft manufacturers can capture this increase in value by either:

1. charging the manufacturer per sensor used; or
2. licensing CVM technology to the manufacturer under a fixed and/or variable annuity model.

We believe a fixed annuity licensing model is better suited to the company’s structure, is more efficient and most importantly locks in revenues year on year for the duration of the agreement.

Airlines

We build a model of the savings that CVM would bring to the normal operations of an airline company, now that CVM technology is commercially approved for use on Boeing 737 aircraft. Consider the following example; for a Boeing 737-800:

- The plane has a capacity between of 150 - 215 economy passengers.
- The company operating the plane runs at an average of 85% of capacity.
- The plane operates a three-hour flight, three to four times per day with average revenues per ticket of \$300. This is an average utilisation of between 9-12 hours/day; the industry average is closer to 9 hours.
- The company’s gross margin is between 30-50%. We disregard the fixed costs of the plane and costs not associated with extra flying time as they are sunk costs. The company has a tax rate of 30% on marginal profits.
- **Based on these assumptions, the cost of grounding a plane for one hour in terms of foregone profit is between \$500 and \$1,400.**

Furthermore, the scheduled maintenance for the average 737-800 is as follows:

Table 1: Plane Check Frequency for a 737-800¹

Amount of Time	A-Check	B-Check	C-Check	D-Check
Between Checks	500 FH = 42 days	N/A	4-6,000 FH = 0.9-1.4 years	96-144 Months
Taken Per Check	10 Hours	10-24 Hours	3 days-1 week	1 month
Average Hours/Year	86.90	-	93.91	72
Average Hours of Overlap	5.31	-	9.39	0
Total Hours/Year	81.60	-	84.52	72

Because a B-check covers A checks, C checks cover B and A checks etc., overlaps in maintenance inspections occur that are accounted for. This gives us an average of 240 hours that planes are grounded for maintenance checks per year.

The company is confident that CVM would save two days or 48 hours (20%) of downtime per plane per year as time taken to open, examine and close sections to check the aircraft structure are saved. Given the cost of grounding a plane for one hour is between \$500-\$1400 in lost profit, **this makes for savings of \$24,000-\$67,000 per plane per year, in indirect costs alone.** David Piotrowski (Principal Engineer at Delta) suggested that the potential savings expressed in terms of foregone revenue are ‘**multi-millions of dollars**’.

To calculate the savings from direct costs, assume two NDT technicians work at the same time on one plane at a rate of \$100/hour. Furthermore, the cost to rent a hangar is \$5000/day or \$200/hour². 48 fewer maintenance hours saves an additional \$19,200 per plane per year. **In the recent investor call, David Piotrowski suggested that as many as 100 man hours can be used to access a section of an aircraft that takes only 10 minutes to inspect; and another 100 hours to close.** Therefore we assume these forecasts to be conservative.

The savings of CVM technology do not stop there; suppose for a cargo plane the addition of CVM sensors meant welds and other structural supports no longer need be over-engineered; and parts could be made from composite rather than metallic materials. This would save weight (either increasing loads or reducing fuel consumption) as well as reducing manufacturing costs of planes themselves.

TOTAL SAVINGS USING CVM TECHNOLOGY

In total, downtime and man time savings total between \$43,200 and \$86,200 per plane per year.

A licensing model that captures 12% of total savings as a result of CVM Technology would yield between \$5,184 and \$10,344 per plane per year to SMS.

The World Airliner Census 2013 puts the current number of commercial aircraft (both regional and mainline) at around 25,000³ with the top 10 mainline aircraft (CVM's most relevant market) at 16,824.

Table 2: Top 10 Mainline Aircraft by Number³

Aircraft	2014	2013	%Change
Airbus A320	5632	5180	8.7%
Boeing 737-6/7/8/900	4693	4265	10.03%
Boeing 777	1188	1095	8.5%
Boeing 737-2/3/4/500	1089	1164	-6.4%
Airbus A330	1020	927	10.0%
Boeing 757	812	846	-4.4%
Boeing 767	795	818	-2.8%
Boeing 717,MD-80,DC-9	744	776	-4.1%
Boeing 747	585	623	-6.1%
Airbus A340	266	298	-10.7%

Based on a very conservative estimate, if CVM sensors are installed on only 25% of all Boeing 737-800 aircraft as of 2014 (4693 aircraft), when using a licensing model that captures 12% of all cost savings, SMS can expect to generate between \$6,080,823 and \$12,135,512 in revenue per year.

The number of aircraft has grown at 5%/year for the last 20 years, and is expected to grow at a similar rate for the next two decades.⁴ Given this market size and using our 737 total cost savings as an average, the total potential for CVM technology could be as high as \$1.3 billion/year growing to \$3.4 billion in 20 years, when accounting *only* for large planes.

Military Aircraft

Approaches to structural health monitoring in the US\$61 billion/year military MRO industry have proved fruitful. Instead of focusing on increasing flight hours, these programs tend to save governments by increasing asset life, reducing direct maintenance cost and reducing over-engineering.

While the potential for CVM applications is strong, demand is likely to be less significant than the commercial market due to:

- Size of aircraft being too low to justify alternate means of NDT/NDI.
- Generic SHM approaches to what are very diverse aircraft.
- Existence of other SHM programs that do not need the approval of central regulatory bodies such as the FAA in the commercial aircraft market.

However for more expensive and technologically advanced aircraft (which may cost more than commercial aircraft), safety and proper maintenance are in high demand; this is backed by the Australian Defence Force's significant interest in CVM technology in the last decade. Additional evidence of this demand is evident in the recent **Sikorsky Aircraft Corporation agreement, where a validation program for CVM technology to address health and usage monitoring on rotor-aircraft is currently underway.** In a statement, the Company said,

“To date, methods that directly pertain to data collection and analysis related to rotor-craft usage and drive system health have been relatively well developed, however, such methods related to structural health monitoring of rotor-craft have been more difficult to develop and deploy in a ‘real world’ operational framework... it is envisioned that CVM may play a ‘first- leader’ role in addressing the current shortfalls, and lack of ‘real world’ deployment [of SHM technologies]”.

SMS has recognised the potential of the military market, and has secured an agreement with a sovereign defence to install and monitor CVM sensors on Apache AH-64 attack helicopters, in anticipation of a fleet wide role out. In addition, **Lockheed Martin Corporation's recent \$9 billion purchase of Sikorsky Aircraft Corporation ensures that SMS is operating at the forefront of structural health monitoring in the military aviation market, with the worlds largest defence contractor.** Lockheed Martin's recent aggressive cost cutting policy, combined with SMS' commercially ready CVM technology, could prove to be a valuable combination for SMS shareholders in the future.

Industry overview: structural health monitoring

Non-destructive testing and inspection (NDT/NDI) of critical structures and components of infrastructure is an extremely important aspect of asset management, safety and operational efficiency. Analysts at Frost and Sullivan⁵ put the global market for NDT/NDI at over \$2.5 billion. The exorbitant cost and challenges involved in building new infrastructure has resulted in significant ageing of existing infrastructure; in turn, extending the useful life of ageing infrastructure is driving the need for inspection services. To assess the integrity and prevent catastrophic failures, NDT/NDI inspection is of paramount importance. Previously, NDT/NDI has been carried out in a labour-intensive manner that requires professionals to physically assess structural damage and fatigue in a painstaking manner.

- This involves either visual identification of structural deficiencies or using equipment such as ultrasonics or eddy currents to detect minute damage both outside and inside structures. Depending on the structure and the elements inspected this could require structure disassembly.
- The shortcomings of this process include significant labour and overhead costs, indirect operating costs of asset downtime, and the static nature of testing which cannot monitor damage as it develops.
- Furthermore, depending on the technology used, NDT/NDI may result in sub-optimal detection of structural fatigue and damage due to the element of human error in inspections, a lack of access to key areas and limits of use of dangerous methods such as x-rays and isotope radiography.⁶
- Despite these drawbacks, NDT/NDI is a necessary process and a regulatory requirement of many industries making applications numerous and potentially lucrative.

The basic approach of Structural Health Monitoring (SHM) is to make non-destructive testing and inspection as much a part of structures themselves as possible⁶. The aim is to detect, where possible, the presence, location, severity and consequences of damage in a structure. SHM is an improvement on existing NDT/NDI because technologies in this area perform the same objective, but on an autonomous

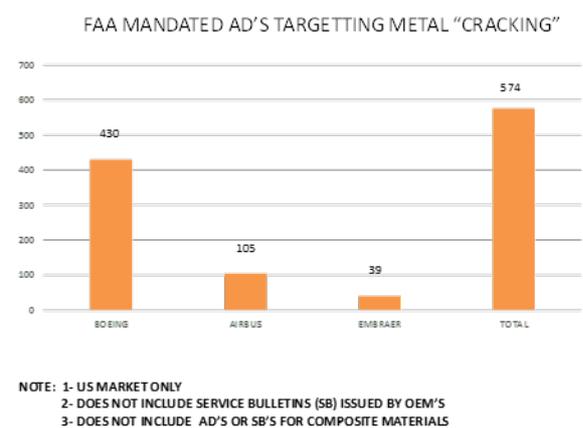
level in a way that gathers superior information about the development of structural damage that can be known in real time or on a periodic basis. Technologies in this market have the potential to add value to businesses using these technologies in three ways:

1. Increasing Asset Productivity:

- Improving NDT/NDI means repairs are better managed, increasing asset life and reducing future repair costs.
- Quicker NDT/NDI processes from SHM will reduce asset downtime while NDT/NDI is carried out.

2. Reducing Direct Costs:

an automated detection of structural damage mean less labour and overhead costs associated with NDT/NDI.



3. Improved Safety:

- Better detection of damage will reduce the likelihood of catastrophic events; a benefit that may be captured by lower costs of insurance on assets and operations of companies who use these technologies.
- Monitoring areas prone to damage will:
 - reduce the need for over-engineering
 - increase innovation in design
 - reduce manufacturing costs
 - allow more loads on structures

“Crucially, the Company’s technology is now commercially approved; is certified for use (with global AMOC status); is in Boeing’s maintenance toolbox and is easy to use”

Management

Toby Chandler is SMS's Managing Director and head of SEAL Capital, a Los Angeles-based hedge fund. Prior to this he was a Managing Director of Morgan Stanley's New York Hedge Fund Desk. MD of SMS since 2011.

David Veitch, acting as non-executive director of SMS. Mr Veitch also worked at Northern Airborne Technology before founding AEM, helping it grow from 10 to 200 employees. He was appointed late in 2012 to non-executive director.

Andrew Chilcott, a non-executive director, was appointed in 2012 after having worked in sales positions for both SMS and Airbus.

Michael Reveley, chief executive of SEAL Capital, has had extensive international experience in financial markets as founder of Seagate Global Advisors (LA) and director of the syndicate and derivatives group at SBC Warburg (London, New York).

Key risks

SMS's share price is highly volatile which reflects the speculative nature of the stock.

2016 will be a telling year for the future success of the company, and therefore we expect share price volatility to continue, helped only by greater market liquidity as more investors are attracted to the company.

SMS's key markets include aviation, energy infrastructure and others that will be strongly affected by macroeconomic conditions and market risk.

These sectors may be unaccommodating of new technologies such as CVM in the event of a market downturn. In particular, commercial aviation is a low-margin business subject to strong macroeconomic fluctuations and market events. Despite this, CVM has a diversified range of applications, some of which are in markets backed largely by public sector spending (such as bridges and military aviation) which may curtail somewhat SMS's exposure to market risk.

Although further approvals from the Boeing/FAA are expected to be obtained in a more efficient and timely manner, that is not to say that these approvals are guaranteed.

Structural Monitoring System's earnings potential will implement a targeted commercialization strategy that overcomes the issues outlined above. One of the major contributing factors to the recent shift in company dynamics has been the complete overhaul of the board of directors with no members serving on the board before 2011.

Despite 20 years of CVM development, the prospects of the technology – while generally positive – are subject to a high degree of uncertainty:

- Undiversified in terms of a product, but diversified across markets.
- Horizontal approach may protect the company from market risk, but subjects the stock to more influence from outside forces than a vertically integrated approach where production, distribution and sales are all under one house.
- The conditions of agreements with major partners such as Boeing, AEM etc. are fairly unclear.
- Competition is a large issue for SMS who must attempt to lead the market and gain first mover advantage.
- FAA approval does not necessarily mean widespread adoption of the product will ensue.

Continued R&D and product development such as FAA testing means continued dependence on additional capital. The company's retained earnings are a staggering –\$45 million with a negative equity balance.

Despite balance sheet issues, we consider financial risk to be lowered given the recent \$3.7m placement, institutional support from Drake Private Investments and the company's commitment to a low cash burn with low net operating cash flows.

SMS does have a very concentrated shareholding, which may cause concerns if one shareholder decides to exit their position.

References

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2. The cost to build a new hangar for an A380 is estimated at \$30m. At a rate of return of 5%, daily rent would need to be \$4,000. Factor in maintenance as well as the fact that the hangar will not always be full and you have a bearish estimate of rent at \$5,000/day.
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MAC EQUITY PARTNERS PTY LTD

AFSL: 338731

ABN: 32 126 369 640

SUITE 7, 29 THE AVENUE, NEDLANDS, WA 6009, AUSTRALIA

T: +618 9386 4787

F: +618 9389 1464

E: INFO@MACEQUITY.COM.AU

W: WWW.MACEQUITY.COM.AU