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FRONTIERS, FOOTPRINTS & THE FIRM

A CRITICAL REVIEW OF CORPORATE SOCIAL RESPONSIBILITY IN SPACE TOURISM

ABSTRACT

Space is a human frontier, and as such promotes frontier behaviour. But with the rapid rise of commercial space travel and corporate activity in space, corporate social responsibility (CSR) is an important issue in developing this frontier.

This study takes a critical review of space tourism and CSR development, asking what companies ought to be doing and why. Its main research method of the investigation is a benchmarking of CSR reporting in 90 space companies, using GRI's G3 indicators and specially-developed set of indicators for space CSR.

The study finds inconsistencies between reporting quality of traditional CSR metrics and the quality of reporting of CSR in space activities. We find large, listed aerospace conglomerates, while performing better in overall CSR reporting, perform less well in reporting space activities than pure space companies. We find pure space companies, regardless of size or location or public/private status, perform well in their reporting of space CSR issues, while not necessarily being good reporters of other CSR indicators. We find most companies could do better in their space CSR reporting, particularly in describing their environmental impacts in space while, guided by CSR theory we find power and ethical CSR theories most appropriate to the industry.

We conclude that stakeholders exert significant pressure on a company's CSR activity, and that, in pure space companies, the space community is the dominant stakeholder. This has implications for mergers and acquisitions, where space CSR may be diluted as companies are purchased and brought into those firms with different stakeholder priorities.

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CHAPTER 1 INTRODUCTION

> *Reality is enacted or socially produced, but in time these social structures become stubborn, resist social change, and thus become constraining." (Murray & Ozanne, 1991)*

The need for a radical critique of corporate social responsibility in the commercial space industry is pressing. Social and commercial structures formed now in space are the foundation for space society and a future space industry – they will be with us for a long time and may be difficult to reverse. In space, we argue, following Hardin's seminal work (1968), we are still at the "cutting the bison's tongue" phase of development. Rocket parts are discarded in orbit; probes are sent to alien worlds with minimal protection of that world against terrestrial contaminants; crew health and safety issues are glossed over (Stafford, 2010); all in the name of exploration and human endeavour.

As Hardin (1968) notes, frontier behaviour is all very well when no population is present. In space, population six[1], frontier mentalities should surely not cause concern. As Fallon (2009) jokes about space tourism, the only person who can afford a ticket to space is Richard Branson – space tourism is today beyond the reach of most folk, and in any case, technically, orbital spaceflight is far from routine, even after five decades of technological development and experience (Stafford 2010, Cassidy 2010). Space is hardly the "new Caribbean", to use a phrase coined by Dickens and Ormrod (2007).

[1] As of June 16, 2010, the population of the International Space Station was six: four men and two women, three Russians and three Americans (NASA, 2010).

But what happens when human and satellite space use increases? When the population of space is not six, but sixty, or six hundred, or six billion? Is it too early to start asking these questions?

We think not. First, the true "population" of space is measured in hundreds of thousands of people who work in space infrastructure, technology and mission support. There may only be six souls orbiting the Earth today, but billions of people rely on the communication and observation satellites sharing their sky. Space and its industry is already generating complicated interlinked social structures which, to paraphrase Murray & Ozanne (1991), will stubbornly resist change.

Second, from a critical perspective, we already see the sociology of space moving in a familiar and undesirable direction. Recently, the term "sustainable" was used in conjunction with a device which cleans up space debris (Amos, 2010). Is this the beginning of the hijack, to use Welford's term (1997) of "sustainability" language in space? Do we want a space future where space debris is created in the first place? Will a space organisation earn a "sustainable" badge simply by cleaning up pollution which it could or should have prevented in the first place? And what about labour issues, consumer issues, human rights, community issues, corporate governance? These too deserve a place in the register of social responsibilities in space, yet without a critical intervention, space debris may well turn out to be the only space issue the public knows or cares about.

1.1 Space Inc.

We believe “corporate” social responsibility will be the key challenge in space development. Space was once the domain of nations, with space activities traditionally spurred by national security interests (Peterson, 2010) amongst states who fought to dominate the heavens. But now, space is increasingly becoming the peaceful preserve of corporations. The US has opened the debate on privatising low-earth orbit operations, and in any case the end of the US Space Shuttle programme in 2010 will give the commercial sector potentially free reign for several years before the US government resumes spaceflight operations at the earliest in 2013. Europe’s space sector is dominated by private firms (Davies, 2009). Therefore, the norms and social structures built around space travel will be heavily influenced by corporations. Corporations will have tremendous power in developing space society, regulatory regimes and even international cooperation.

But while corporations may paint a face of “corporate citizenship”, they are not citizens – they cannot vote or hold public office (Banerjee, 2007); they can live forever and change ownership; they can completely change their characteristics and behaviours, they can split, merge or close down. As Banerjee cites Thurlow (Banerjee, 2007, p. 15) the corporation “has no soul to be damned and no body to be kicked”. Yet, through their policy positions, their behaviour and interests can quickly become normative – and as Banerjee writes, they wield considerably more power than a democratic citizen: “In the US, ballot box power is no match for boardroom power” (Banerjee, 2007, p. 46). Since corporations can behave badly even here on Earth, where trade, commerce and labour are

controlled by very clearly defined legal structures, what sort of behaviour could we expect by an unfettered industry working in the lawless expanse of outer space?

1.2 Responsibility

Despite protracted discourse on corporate social responsibility (CSR), there are still gaps today between the CSR principles held by stakeholders such as NGOs and civil society groups and the norms promoted at corporate level (Dobers & Springett 2010). Indeed, there is even widespread confusion as to how to define CSR (Dahlsrud, 2008). Furthermore, citing Ählström et al (2009), Dobers and Springett (2010) point out relatively little CSR discourse has been viewed from a critical perspective.

CSR proponents claim CSR can drive company competitiveness and profitability (Oxfam Hong Kong, 2010). We would dispute this – it is very hard to prove CSR activities are *bad* for a company, but at the same time there is very little scientific proof that CSR is actually good for a company (Vogel, 2005). At best, a weak positive correlation can be found (Levy, Brown, & de Jong, 2010); but then, well-managed, financially successful companies are likely to devote more resources to social performance (Levy, Brown, & de Jong, 2010, citing: Guerard, 1997; Margolis, Elfenbein, & Walsh, 2007, Simpson & Kohers, 2002; Waddock & Graves, 2000). Trying to find a tangible benefit for CSR is, in our opinion, hiding the true value of CSR as a process for addressing corporate power in society.

Therefore our investigation attempts to avoid labelling or prescribing behaviour – a fool's errand in the frontier of space. We are not necessarily looking at "bad" corporate behaviour in the sense of blatant dumping of toxic waste, flaunting labour laws or taking

unnecessary risks with shareholder's capital – the study will focus on power and social structures, and the corporation's weight in building our future society. Nor can we necessarily define "good" behaviour – as Hardin (1968) and Redclift (2000) note, what is perhaps appalling to us here may be the only option in a frontier situation. Instead of focussing on the "good" and "bad" we will address some of the pressing issues and help prevent the "ugly" CSR (Banerjee, 2007) becoming the norm in space as it has threatened on Earth.

We will therefore look at responsibility as a concept, to understand, through the lens of critical theory, the motives, perceptions, interests and intentions of the various actors (Murray & Ozanne, 1991); and to frame this with theories of corporate behaviour, modern CSR, space sociology and ethics as discussed in the literature review.

Our literature review will help understand why companies participate in any form of responsibility other than profit-making; and what may constitute good corporate behaviour not in terms of actual CSR initiatives but in terms of power, transparency and social commitment.

1.3 Target: space tourism

We have chosen space tourism as our title sector. It may be over 40 years since Barron Hilton pledged to build a hotel in space (Hilton, 1967), but while the sector has yet to take-off in any meaningful way, it is one of the most attractive areas to study in terms of public perception and commercial potential. Space tourism is already giving regulators concern, with the potential for hundreds of launches per week posing a major challenge for US regulator FAA (Nield, 2010). It is also likely the most public-facing and

accessible space industry (Billings, 2006), and therefore, from a critical perspective, the most likely route to publicity and change. As a new industry offering a highly dangerous service, space tourism faces serious challenges in governance, safety, consumer issues, fair operating practices, public expectations, lobbying and policymaking, labour issues, regulatory issues, as well as environmental issues, and is therefore an excellent base for our study – in examining it, we will investigate the wider commercial space industry; as well as interactions between private companies and national space agencies, regulators and even astronauts.

1.4 Purpose and outline of the study

Our key research questions focus on CSR and its application in space. At what stage is CSR in the space industry? What are some of the power and relationship structures between government and business (viewed through a CSR lens) which will shape our future space society? What are some of the key issues in CSR relating to space tourism?

We begin by outlining some perspectives on space: technical, legal and commercial. We introduce space tourism, and highlight some of the known environmental, social and ethical issues in space itself. We then turn to CSR theory. What is CSR, how has it developed, and how may it apply to the commercial space sector?

With little existing work on CSR in space itself, we must first address exactly what is the status of CSR in this sector; we will achieve this through a comprehensive benchmarking of voluntary CSR reporting in 90 space companies. We will present a qualitative (and,

where appropriate, quantitative) analysis of the results, and then discuss the results by examining a cross-section of companies in more detail.

1.5 Critical theory approach – a note on structure and theorisation

This is a critical study grounded in the recent work of Welford (1997), Murray & Ozanne (1991) Springett (2005), Bannerjee (2007), Jones (1999) and many other critical writers including classics from Lukes (1974) and Marcuse (1978). While a CSR benchmarking formed a large part of the research for this investigation, it is not our aim to make a purely quantitative study or hypothesise that, for example, larger companies listed on the New York Stock Exchange based in the US would perform better or worse at CSR in space than smaller private companies based in Europe. Rather, through our critical analysis we hope to produce arguments that may bring about further debate, change and awareness in the industry while lending some concrete measurement and analysis to the future debate with our benchmarking study. Critical research goes beyond publishing a paper and seeks positive change as its evaluative criteria (Welford, 1997 after Murray & Ozanne, 1991): it seeks ‘to make a difference’.

CHAPTER 2 PERSPECTIVES ON SPACE

"Using the commons as a cesspool does not harm the general public under frontier conditions, because there is no public; the same behavior in a metropolis is unbearable. A hundred and fifty years ago a plainsman could kill an American bison, cut out only the tongue for his dinner, and discard the rest of the animal. He was not in any important sense being wasteful. Today, with only a few thousand bison left, we would be appalled at such behavior." (Hardin, 1968)

"Richard Branson, the CEO of Virgin Galactic, just unveiled a new spaceship for rich tourists who want to travel to space. So far the only person who can afford a ticket is Richard Branson." (Fallon, 2009)

2.1 What is space?

Space cannot be sharply defined, legally, technically or philosophically. Technically, the upper limit for sustained air flight is around 40km and the atmosphere provides very little aerodynamic lift above 80km (Schauer, 1977). But space does not start here – the lowest altitude which can support a satellite orbit is around 160km (Schauer, 1977). The International Space Station (ISS) orbits the Earth once every 90 minutes at around 350km (NASA, 2010). One definition of where space "officially" starts could be derived from space mission entry interface (EI) – NASA marks the end of a space voyage, and begins "EI" time, when a spacecraft returns to 400,000ft (122km) (NASA, 2003).

2.1.1 Technical view of space

From a technical point of view, much of the marketed "space tourism" merely grazes the edges of space. In space travel, altitude itself is less important than escaping Earth's gravitational pull – to truly escape Earth requires an enormous amount of energy. Earth's "escape velocity" [2] is around 11km/s, 30 times the speed of sound. To date only rocketry can achieve such high energy escapes – even NASA's fastest experimental jet can only reach a quarter of this speed, while Virgin Galactic's Spaceship Two misses it by a factor of 10. But only by reaching this speed will a satellite, astronaut or payload be able to achieve a stable orbit or travel beyond Earth. Craft reaching space-like altitudes at lower speeds are merely "bungee jumping" into space and will soon be brought back down to Earth by gravity.

This will be an important distinction in our study, since no commercial space tourism operation has anything like the capability to boost human passengers to escape velocity, while marketing may indicate otherwise. As such there may be an expectation gap between the general public's perception of space tourism, space tourism marketing, and reality.

2.1.2 Legal view of space

Legally, space is a complicated realm. Zhao summarises the situation neatly:

[2] For Earth, the escape speed in an Easterly direction is 10.735km/s, and 11.665km/s in a Westerly direction (Wikipedia, nd). The escape speed required increases with latitude, which is why most launch sites are located closer to the equator, something which will be considered in our "power" section.

> *Drastically different from other means of transportation, such as shipping and aviation, which are governed by a comprehensive framework of national and international commercial law, space activities are supported by inter-governmental treaties negotiated during the cold war." (Zhao, 2009, p. 82).*

The situation is complicated by the dual-nature of spacecraft, which may takeoff as rockets and renter as aircraft; or takeoff as rockets strapped to aircraft. International law applies. Even international space law flounders on how to define a "space object". The UN Convention on International Liability for Damages Caused by Space Objects or Liability Convention contains definitions clearly made redundant by the multicultural ISS (Zhao, 2009, p. 49). This researcher has shaken the hand of the American astronaut who physically bolted an extension to the Japanese portion of the ISS – does the US government own his handiwork? Could cold war governments ever have imagined a Russian spacecraft delivering a US citizen to an orbiting laboratory built by the Japanese, US, Australians and Russians – for a holiday? The laws and treaties of the UN had little imagination for such developments.

Space law will need to develop quickly once space travel becomes more commonplace. At present, US citizens applying to the General Land Office for settling or homesteading rights on the Moon are told their application must be supported by "an affidavit declaring that the applicant has personally examined the land and is well acquainted with its characteristics." (Pop, 2009). For now, this catch has prevented any applications proceeding further – but for how long?

2.1.3 Business perspective of space

From a business perspective, we can identify two distinctive types of commercial space company: downstream and upstream (Davies, 2009). Upstream companies provide the hardware (eg satellites, rockets, emergency systems, communications, launch infrastructure), and launch the hardware, cargo and humans into space. Downstream companies use upstream-created hardware to offer applications and services such as mobile phones, handheld GPS devices, satellite TV and Earth observation imaging (Davies, 2009). There is considerable cross-over, with many upstream companies offering downstream services. This study, however, will focus on the upstream, as upstream companies are active within the physical realm of space itself [3]. Upstream companies have physical products in space, be they spacecraft or batteries within a Mars rover; or they design the services and social structures which support those physical space activities; such as launch services, consulting, safety and communication.

In terms of markets, satellite communication is the largest space industry – upstream companies create value – through satellite infrastructure – for the downstream companies, who tend to be large media or telecommunications companies.

[3] It may well be that, in the future, navigation equipment sales companies for example will be held accountable for their satellite provider's environmental performance in space, for example, but we do not see this today - try asking someone with satnav or GPS who launched the satellites, or who made them. Satellite providers or earth observation are a long way from the "Intel Inside" style consumer face.

Navigation is becoming a well established business segment, while the Earth observation (EO) commercial market is just beginning to emerge (Davies, 2009). As Table 1 shows, space tourism is yet to develop as a major space industry.

Table 1: Markets for space

Market	Players (state/commercial)
Satellite communications	Largest commercial market. Limited state and commercial players upstream and huge downstream market
Navigation	Upstream dominated by US GPS, no commercial players; downstream huge market of devices, chips and applications.
Earth observation	Upstream players creating significant opportunities for downstream market, particularly SMEs
Space tourism	So far, the only orbital space tourists have been flown by Russian state to ISS. Upstream companies mostly engaged in high-altitude operations.
Space finance and insurance	UK is a centre in satellite insurance

(After Davies (2009) and author research)

There are very few larger scale (revenues above $1.6m) "pure" upstream space companies – Davies (2009) identified Astrium as the only large space company in the upstream business in Europe totally dedicated to space business.

2.2 Some issues in space and space tourism

> *"Tourism poisons itself in small doses" (Robledo and Batle, 2002, p86, cited in Argandoña, 2010)*

The above quote was cited in Argandoña's study of CSR in the Spanish tourism industry – in Spain, the government's policy to promote tourism through supporting the construction of low-cost accommodation led to destructive overdevelopment (Argandoña, 2010), with neither individual, collective or political action able to solve the problem. But while the tragedy of the commons has already played out on the playa, space today remains a largely virgin frontier.

As our literature review will show, we are less interested in specific environmental and social aspects of space tourism than the power structures and sociologies which will determine how such aspects would be handled and managed. Nevertheless, we introduce one key topic here: space debris.

2.2.1 Space environment

The most commonly understood space environmental issue is space debris, a field of debris extended from around 200km well past 39,000km above Earth (Krisko, 2007). Debris includes naturally occurring meteoroids as well as objects including: spent intact satellites; missions related debris (objects released in the course of spacecraft deployments and operations); fragments of intact satellites resulting from accidental or intentional collisions; radiator coolant droplets from or-orbited and ejected nuclear cores; solid rocket motor exhaust products; ejecta from micro-particle impacts and paint flakes (Krisko, 2007) .

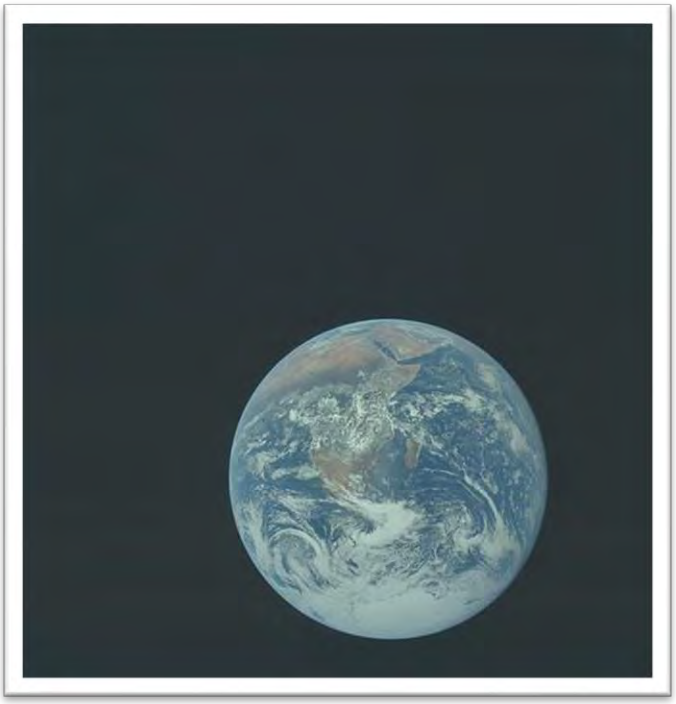
Table 2: LEO space debris source and size ranges, after Krisko (2007)

Orbital debris source	Size range	How observed	Estimated number on orbit (2006)
Defunct payloads and rocket bodies	>5cm	Tracked and catalogued	3,600
Mission-related	<1m	Tracked and catalogued	1,270
Fragments of on-orbit explosions/collisions	<1m	Tracked and catalogued, <10cm observed statistically	>1,000,000
Sodium potassium coolant droplets	1-5cm	Observed statistically	~55,000
Solid rocket motor char, slag and dust	~5-100cm	Observed statistically (and on "returned surfaces" of Shuttle, ISS Modules)	Unknown
Ejecta and paint flakes	<1mm	Observed statistically (and on "returned surfaces" of Shuttle, ISS Modules)	Unknown
Meteroids	<1cm	Observed statistically	Unknown

Based on historical data and projecting forward to 2035, Krisko's modelling work points to a the most collision activity occurring in regions of high traffic in the LEO, altitude bands 600-1,000km and 1,400-1,500km. The risks are not growing significantly, finds Krisko's model, with an overall effect of increasing the collision rate to a handful of events per year by the end of 2035, with non-catastrophic collision between small impacts (less than 10cm) and large targets (greater than 10-cm) by far the dominant mode of collisions in Krisko's modelled environment (2007). A million pieces of debris may sound like a lot, but in the vast expanse of low earth orbit, it roughly equates to only one

object per million square kilometres. Navigating this field would make for a very dull video game. This is at-odds with the popular media presentation of the issue: *National Geographic* talks of "shrapnel" moving at "hypervelocity" (Lemonick, 2010).

CHAPTER 3 LITERATURE REVIEW



We open our literature review with a photograph, the "Blue Marble"[4], one of the most enduring images from the Apollo Space programme. This beautiful photograph, showing for the first time our self-contained fragile Earth, is widely credited with igniting the whole environmental movement (Henry & Taylor, 2009).

What is rarely discussed about this photograph is that it is upside down. The original plate from Apollo 17, seen in sequence, shows the white of Antarctica at the top. To our critical eye, we find it fascinating the very symbol of environmentalism hides within it an insidious message of North *vs* South power relations[5]. This is an excellent image for our

[4] NASA photograph AS17-148-22727 from Apollo 17, December 1972, commonly known as "22727", "Whole Earth" or "Blue Marble".

[5] "Maps with north on top became common centuries ago. European sailors were beginning to navigate using the North Star and magnetic compasses to guide their way across the oceans. Because

critical study of social responsibility in space. Environmentalism is just the surface – the deeper issue is power.

To discuss purely environmental aspects of space operations, we would address literature on space junk, planetary contamination and perhaps the impact of solar radiation on crew safety. As Chapter 2 has shown, these are all fascinating and engaging topics: but to merely look at environmental aspects is to fall into a trap which many have succumbed. As Welford writes, we must "nail that lie" that "sustainability" is "eco-development" (Welford, 1997).

CSR, from a critical perspective must be about much more than a company's environmental or community performance. We will look at the concept of responsibility, at company behaviour prescribed and observed, using this background to frame a discussion on power.

But first, we start with a brief outline of the elephant in the room, concerning discussions on CSR – a concept perhaps first coined by those very early images from the Apollo space missions: sustainable development.

3.1 Substance D

If sustainable development (SD) is about maintaining resource use and pollution at a level nature can regenerate (Sachs, 1999), then at what radius do we draw the circle of

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they were from Europe, it was only natural for them to put their homelands in the place of honor at the top of their maps. Before that, many maps were oriented, or turned, toward the east, where the sun rises. The east was considered to be holy, so those maps showed east on top." (Henes, 2005)

regeneration? Sachs (1999) considers whether the circle is at the level of a village community, or a country, or the entire planet? With our study into space travel, we must ask why stop at the edges of the biosphere? Why not draw a universal circle? Alas, this sounds the death knell for sustainable development; we can hypothesise a universal circle contains infinite resources and can support an infinite population in infinite activities, equity issues aside, rendering sustainable development nothing more than a tool to divide wealth between sub-circles of regeneration.

As such, wider space travel and development will require new thinking in sustainable development. In any case, our research and reading convinces us "sustainable development" is an ugly bastard, with its questionable heritage, provenance and definitions, its appropriation by "executive cliques" (Mayhew, 1997) and its subtle preservation of the *status quo* that "development" is "growth". Indeed, the concentration on "growth" has served to obscure the fact that resource depletion and unsustainable development are a direct consequence of growth itself (Redclift, 1987).

We stress this point here precisely to avoid accidental appropriation of the term "sustainable" in our work. The sustainability of the corporate "sustainability reports" we read is not the same concept as theorised by many academics, philosophers, critical thinkers, NGOs, environmentalists or chief executives.

A principal weakness of radical environmentalism is how it fails to explain how a new better society is to be brought about (Redclift, 1984, p. 41). Indeed, implying a new "philosophy of human conduct" (O'Riordan 1981: ix), it is no surprise that

environmentalism fails to move boardrooms. Following Redclift and O'Riordan, and substituting "sustainable development" for "environmentalism" the problem is clear.

But taking sustainable development as a process (Welford, 1997), and understanding natural conflicts and tensions between that process, social responsibility and the financial and capital structures of modern institutions (Levy, Brown, & de Jong, 2010) brings us to the Global Reporting Initiative (GRI) and its "version" of sustainable development. GRI's creators managed to align business and some form of sustainability. "GRI would never have made any progress had it directly challenged the primacy of profit maximisation, the legal rights of shareholders, the autonomy of corporate management or the conventional US corporate board structure that excludes representatives of the community, the environment, or labor" (Levy, Brown, & de Jong, 2010). Writers such as Mayhew (1997) and Doane (2004), might say the appropriation of sustainability by executives is a problem – but with a pragmatic hat on, and in examining CSR and sustainability in the corporate world GRI's sustainable development ideas, for its limitations and criticisms, is a good tool to help us understand and measure corporate behaviour.

We note with interest how the "centre of gravity of non-financial reporting (NFR) has shifted from the non-governmental organisations (NGOs) [who started it] towards corporate consultants and auditors" – unlike radical environmentalism, GRI did not "fail to move boardrooms" with is sensibilities of sustainable development; but it *has* failed to move NGOs and socially responsible investors (Levy, Brown, & de Jong, 2010). Perhaps we have a very short window before the left brain of CSR is entirely repressed by the right brain of economics and capital hegemony – but again back to Welford's (1997)

"process", let's use what we have today as a tool, no matter if it might soon disappear into an auditor's back-room. We will use GRI methodologies in our benchmarking study, and discuss this more in the methodology section of our investigation.

But back to "sustainability" and corporations, how does an earthly SD compare with ideas of space SD? We can compare GRI's boardroom friendly definition with some latest space thinking. GRI says: 'Achieving sustainability requires balancing the complex relationships between current economic, environmental and social needs in a manner that does not compromise future needs." (GRI, 2006)

But sustainability in space does not just apply to the familiar concepts of sustainable development on earth. Short-term, Pace outlines some of the major challenges to US space sustainability: human access to space; rebuilding the stock of human capital with space expertise; redefining contracts and contractors. Longer term, the challenges may be in more familiar "sustainable development" territory:

- a recognition of how space is a "global commons" we need to protect;
- improving space situational awareness across all sectors and all space-faring nations;
- international discussions on "rules of the road" and "codes of conduct"
- space weather predictions;
- standards – Mars Rover has the ability to communicate through both European and US spacecraft in orbit above Mars as the result of open, international standards; and

- international recognition of property rights for the commercial development of in-space resources.

In summary, Pace asks, can we live off the land? Can we make it pay? “If the answer to both is yes, we will see space settlements and the incorporation of the solar system into our economic sphere. If the answer is no, then space is a form of Mount Everest, good for personal challenge and tourism. But nobody really lives there.” (Pace, 2009)

Whether space develops as a Mount Everest or part of our circle of regeneration, issues of corporate social responsibility and power will be crucial to development – we now turn to the provenance of CSR theory to understand these issues better.

3.2 Corporations, social responsibility and CSR theory

> *The vast literature on CSR is strangely silent on the issues of power in framing the institutional and organisational principles designed to address social issues” (Banerjee, 2007, p. 21)*

3.2.1 Company theory and CSR theory

The literature will help shed some light on a fundamental question of this thesis: How could, or should, companies today, operating in the unchartered business territory of space, apply themselves to that “fundamentally subversive doctrine”, as Milton Friedman termed CSR (Banerjee, 2007, p. 5).

Of course it is rather challenging to open a discussion of CSR with a definition from Friedman. Banerjee notes that Friedman’s comment, ‘the business of business is business’, is today becoming an almost tiresome cliché (Banerjee, 2007, p. 51) and

positions this point of view as one of two polar opposites in corporate social responsibility spheres, the other pole occupied by the extreme Left. The Left has its own critics: Davis (1960) says those who believe business should assume responsibilities as some sort of "social godfather, looking after widows, orphans, water conservation, or any other social need, simply because business has large economic resource," are wrong. Jacoby (1973) sums it up, saying both extremes are in error: 'Economists who assert the "purpose of business is business" and not social "do-gooding" are as much in error as the radicals of the new left who would compel business to concentrate on social improvement' (Jacoby, 1973, p. 198).

Nevertheless, in our field of study, Friedman's view of CSR is a useful place to start. At least on the surface, our first impression of companies operating in space is that they follow a "business is business" approach to their extra-terrestrial activities (this will be studied in great depth in our benchmarking study, beginning Chapter 4). The issue of social responsibility in space, corporate or otherwise, is yet to enter the discourse in any meaningful manner, and why should it? Space tourism is not just the pesticide business before *Silent Spring*[6]: it is analogous to the pesticide business before the invention of DDT. So from a Friedman position, why should the nascent, or developed, space corporation pay any attention to its social responsibilities in space, beyond its legal requirements (and bearing in mind its legal requirements in space are in any case difficult to define)?

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[6] Rachel Carson's *Silent* Spring (Carson, 1962) is often acclaimed as the first book of the environmental movement, the "volatile vapour", as it were, ignited by other factors such as the Whole Earth photograph into a fully fledged environmental movement.

When addressing space tourism CSR we would take into account what a corporation *must* do, *ought* to do and *can* do (Leisinger 2005 cited in Banerjee, p18). As such, the following review of CSR literature will take in several angles and viewpoints: Why do corporations engage in CSR? Why should corporations engage in CSR? What's in it for them? What are the normative and ethical questions about what corporations ought to be doing, viewed from a critical perspective? The answers to some of these questions will outline the form of a company, CSR and stakeholder theory which will frame our investigation of actual CSR practice in space and space tourism.

3.2.2 Evolution of CSR

Banerjee points to CSR as a field of study in management evolving in the 1950s (Banerjee, 2007, p. 5), although we could trace the origins of social accounting studies back to the early days of the modern corporation, with writings from Berle in the 1930s, for example, focussing very much on the legal curiosities and responsibilities of this relatively new beast, the "common stock corporation" (Berle Jr., 1931). But despite eighty years subsequent discourse on CSR, there are still gaps today between the "CSR" of NGOs and civil society groups and the norms promoted at corporate level (Dobers & Springett 2010), and, indeed, even as we have already noted, there is widespread confusion as to how to define CSR (Dahlsrud, 2008). Okoye (2009) goes as far as to ask if a definition is even necessary, while we also could paraphrase Welford's writing on sustainable development (Welford, 1997) to say the search for a definition of CSR is fruitless – we are really talking about a process rather than a tangible outcome.

It is a subtle distinction that early CSR theories did not develop to prescribe behaviour *to* corporations, but rather to explain the inconsistencies between classic economic theory and the reality of corporation behaviour as observed by CSR theorists. For example, why some corporations in highly concentrated industries refused to behave like monopolists; why they would continually innovate and bring new products to the market; and why profit rates of the large companies were lower than those of medium-sized companies (Jacoby, 1973, p. 194). It is important to distinguish between CSR models which aim to explain company behaviour; and prescriptive CSR models which show perhaps what a corporation ought to do and why.

We will use both: company theory to explain why companies adopt CSR; and prescriptive models from corporate thinkers, academics and even the new ISO standard to look at what is considered the norm in CSR desirability.

This two-pronged approach to the literature will help us analyse company CSR behaviour following our benchmarking.

3.3 Why do companies engage in CSR

CSR proponents claim CSR can drive company competitiveness and profitability (Oxfam Hong Kong, 2010). We would dispute this – it is very hard to prove CSR activities are *bad* for a company, but at the same time there is very little scientific proof that CSR is actually good for a company (Vogel, 2005). At best, a weak positive correlation can be found (Levy, Brown, & de Jong, 2010); but then, well-managed, financially successful companies are likely to devote more resources to social performance (Levy, Brown, & de Jong, 2010, citing: Guerard, 1997; Margolis, Elfenbein, & Walsh, 2007, Simpson &

Kohers, 2002; Waddock & Graves, 2000). Trying to find a tangible benefit for CSR is, in our opinion, hiding the true value of CSR as a process for addressing corporate power in society.

But why participate at all? Especially in a field such a space tourism, or even space components, where the traditional CSR-attributes, as McWilliams & Siegel (2000) discuss, of a product or company are unlikely to be a competitive factor in consumer choice. According to Crouch (2001), demand for space tourism is likely to be a function of the following factors:

- price, primarily; and
- duration of the journey;
- conditions aboard the spacecraft;
- available activities or experiences before, during and after the flight; and
- the perceived level of safety. (Crouch, 2001).

Even nine years since Crouch's paper, we don't picture crew safety, for example, or social, governance or environmental aspects as likely to be a factor in space travel demand. Further research into passenger demand would be useful.

3.3.1 Why CSR?

CSR is hard to define in practice, even with the benefit of a new ISO standard. To further develop the groundwork for our discussion of space tourism CSR, we now examine why companies engage in CSR in the first place – we hope this will illuminate some of the drivers for a development of CSR concepts in space. We find a classification of CSR theories in Garriga and Melé (2004) who note four types of CSR theory:

1. Instrumental; theories advancing economic objectives through CSR;
2. Political: theories advocating corporate power and it responsible use
3. Integrative: theories expressing the necessity for corporations to integrate social demands
4. Ethical: theories examining the morality and rightness of corporate social action – what companies *ought* to do.

((Okoye, 2009) after (Garriga & Melé, 2004)

We take instrumental and political theories as the basis for our existing company model, starting with the instrumental theory of Jacoby. Jacoby[7] was one of many writers in the 1970s noting a shift of CSR towards "enlightened self interest" (Jacoby 1973, (Banerjee, 2007, p. 19).

Jacoby points out that, by the 1930s, the classic economic model of the firm could no longer explain the involvement of the corporation in society. The traditional view of the corporation "did not contemplate involvement by the firm in the solution of social problems in the sense that we now understand it" (Jacoby, 1973, p. 191). Jacoby developed the Social Environment Model of the corporation as a way to explain some of the gaps in corporate behaviour. Under the social environment model, the enterprise reacts to the total societal environment, and not merely to markets. The corporation

[7] Neil Jacoby had a visionary view of corporate social responsibility. Writing in 1973 he forecast that in 2000 "every substantial business will maintain a 'social account' of its outlays for social projects outside of its normal business activities. 'Social accountants' will routinely make an annual 'social audit' of corporate performance, which will be published along with the company's audited accounts." (Jacoby, 1973, p260.) The name "social accountant" appears to have dropped out of vogue, although it seems quite a catchy term and perhaps worthy of a revival.

responds to political pressures, that “voice” which is absent from any economic theory (Jacoby, 1973, p. 195).

Under Jacoby’s Social Environment Model (Jacoby, 1973), the contemporary corporation must become socially involved in order to maximise its profits. Jacoby’s point is that a corporation’s socially “ameliorative” activity is undertaken because it serves its enlightened self-interest; and that American business activities tend to support this theory – for example, corporations would build hospitals in communities in which they had facilities (Jacoby, 1973, p. 197).

This will be a useful point in our benchmarking analysis and, taking “space” as a community while applying Jacoby’s ideas may provide some answers to unusual and unexpected behaviours.

The effect of this enlightened self-interest is that, just as we are seeing in space today, the lines between government and the corporation are blurred, particularly in places where government is weak and the corporation is strong. As Jacoby noted in 1973: “Private corporations will more frequently be used to attain public purposes” (Jacoby, 1973, p. 69). Or we can cite Banerjee in 2007, quoting a Shell executive working in Nigeria: “Things are back to front here. The government’s in the oil business and we are in local government.” (Banerjee, 2007, p. 53). And in 2010, in the US, the Augustine Commission (Review of U.S. Human Space Flight Plans Committee, 2010) recommended privatising supply lines to the ISS.

Thus the “social” has became political (Banerjee, 2007), which lends a good theoretical framework to our research not just in social responsibility but in “power” dynamics and voice.

Banerjee would agree with the “norms of legitimacy” placed on the corporation (Banerjee, 2007, p. 20); but points out that while stakeholders such as customers, employees, shareholders and governments can withdraw legitimacy from a company, others have limited power to do so – those people who live close to a proposed uranium mine, for example. While we try to avoid fantastical science fiction in this study, it is interesting to consider how the existence of extra-terrestrial life would fit into stakeholder theory. An alien microbe may have limited success in withdrawing legitimacy from a planetary mining corporation. Then again, Gray (Gray, 1999) points out the case of Spaceport Hawaii – residents mounted a successful campaign to scuttle the equatorial spaceport’s construction, claiming the site was sacred land. “Those who would propose to build a civilisation in space without taking account of the motivations of nations, financial institutions or individuals should take warning from the experience,” he writes (Gray, 1999).

But the crux of Banerjee’s critical analysis says stakeholder “engagement” is really about “managing the stakeholders” (Banerjee, 2007, p. 44) and, indeed, in addressing the CSR industry rather than the ‘true’ stakeholders (Banerjee, 2007, p. 40). For example, he discussed the hundreds of reports into the “impact” of mining on aboriginal people in Australia. “Why not discuss an independent aborigine future which *doesn’t* rely on mining?” he asks (Banerjee, 2007, p. 37).

As such, stakeholder management can damage the interests of external stakeholders while portraying an image of stakeholder engagement (Banerjee, 2007, p. 40 citing Thomas, 1999). This is exactly the point Banerjee makes when defining "ugly" CSR: "an abuse of corporate power while attempting to portray a caring and responsible citizen through relentless PR. (Banerjee, 2007, p. 167).

3.3.2 Power

Jacoby, in a critical analysis of this situation, points out the dangerous power imbalance inherent in a society run by corporations. "Should the power of any enterprise become inordinate, the remedy is to curb that power – not accept it and then ask the firm to become more socially 'responsible' in using it!" (Jacoby, 1973, p. 197) he warns. This is a critical point in our investigation of space tourism development. The idea of private enterprise providing the necessary social structure as its social responsibility could be one way to look at the situation developing in the US space industry in 2010. A beleaguered and fiscally challenged government is outsourcing the expensive and mundane task of space station supply lines to the private sector, while it concentrates on the more generationally-enduring king-making missions to Mars and untouched asteroids ripe for footprints and flags.

3.3.3 Government and commerce in space

Following Sadeh, Livingston, Matula, & Benaroya (2005) we note three distinct models for development in space specifically lunar development:

- the American Frontier model;
- the colonial model; and

- the public/private partnership (PPP) model (Sadeh, Livingston, Matula, & Benaroya, 2005).

The frontier model is based on the manner the US settled its own western frontier, with a "boomtown or bust" mentality, resulting in sometimes lawless and violent settlement – a high risk model for business endeavours. On the other hand, imperialist development generates wealth through political control, war and sweatshops and also poses risks to business (although Sadeh Livingston, Matula, & Benaroya (2005) note the generation of some legal order in the form of unions to protect the workforce). The PPP model, however, calls for an entirely new 21st century vision of business and governmental cooperation. It avoids costly consequences that burden businesses in both the frontier and imperialist models, but does raise ethical challenges involving political power and legal issues (Sadeh, Livingston, Matula, & Benaroya, 2005).

The government/corporation relationship is critical to our study – and it is not a new story in space, even though corporations are only beginning to take on a public role. Jacoby had interesting insights into the "military industrial complex, as President Eisenhower termed the mighty American commercial military establishment. His ideas have particular relevance to the development of commercial space today. While many paint Eisenhower's speech concerning the might of the "Military Industrial Complex" as a sinister warning (Dickens & Ormrod, 2007), Jacoby says the president was not implying a conspiracy or evil "complex" as those words might inspire today. The word complex, in its precise sense, means "an entity composed of many interrelated parts" and Eisenhower's point was that any such establishment, then accounting for around 8% of the US GDP, with thousands of installations and millions of employees, "could not fail to

exert a significant influence upon the American society" and should be carefully watched (Jacoby, 1973).

Jacoby's insight is particularly useful today; just as today as the US government attempts to privatise the space "complex", so in Jacoby's day the government was attempting to privatise the military. "The motives of turning to private industry were to escape Civil Servicer barriers to the recruiting and rewarding of talented scientists and engineers... to provide incentives to create performance impossible in a government bureaucracy." It sounds very familiar to the arguments put forward today (by the space business) about wresting power from NASA's hands and putting space development under the care of the commercial sector.

Jacoby's fundamental conclusion is that the public understanding of the business-government relationship must be developed and clarified "if our pluralistic society is to function at its best in the future". (Jacoby, 1973, p. xvii). Taking Jacoby's conclusion provides a clear focus for our analysis of the company's CSR activities – the relationship between business and government in space and space tourism development.

3.4 What companies "ought" to do

There's no shortage of advice on what a company *should* do regarding its corporate social responsibilities, at least for its terrestrial operations; here we here present three points of view, in increasing applicability, using three sources: the philosopher, the business leader, and the international standard.

3.4.1 Responsibility and avoidance of avoidance

Gunder & Hillier (2009) discuss the "empty signifier" of responsibility and take a Lacanian approach (after philosopher and critical thinker Jacques Lacan) to understanding what it really should mean. They cite the example of the UK decision over whether to accept "toxic ships" for dismantling. If the UK, with its strict labour and environmental laws, did not accept the work, it is likely the ships would be dismantled by hand on a beach in Asia (Gunder & Hillier, 2009, p. 162). Citing Watts' "six degrees of separation" (Watts, 1999), and underlining that one is no longer isolated and, indeed, we are all remarkably connected to any other citizen of the globe, Gunder & Hillier point out that social relations that connect actors in such examples are no longer restricted to local authority or national borders, a philosophy more appropriate to space travel than any terrestrial activity – working through notions and philosophical ideas about responsibilities, Gunder & Hillier outline what they call "some suggestions for globally responsible practice, which might aid the reader's self-reflection" [8], with the ultimate suggestion, "Above all, [responsibility is] the avoidance of avoidance" (Gunder & Hillier, 2009).

We will take this "avoidance of avoidance" as our watchword when analysing company behaviour and responsibility. We cannot criticise a company for doing nothing for its

[8] Their suggestions, in full, are: "An acceptance of uncertainty; a willingness to have regard to feelings of dis-ease and dissatisfaction about expected courses of action and to explore why these feelings arise; a willingness to take responsibility for the outcomes; a willingness of care for the other; a willingness to consider our actions in a global context, not just within territorial and institutional boundaries; a willingness to support global justice towards the Other, human or otherwise; willingness to critically reflect on our consumption and those in wider society in light of ecological sustainability; a willingness to advise political decision-makers, accordingly; and above all, the avoidance of avoidance." (Gunder & Hillier, 2009, p. 179)

local community – we could even praise it, from some stakeholder perspectives. But we can view "avoidance" as poor behaviour from every perspective.

3.4.2 Three levels of responsibility

We now discuss the views of a business leader, a well respected company chairman in the UK, Sir Adrian Cadbury. Monks and Minow (1995, p. 46) cite Cadbury's "three levels of company responsibilities":

1. Material obligations to shareholders, employees, customers, suppliers and creditors, to pay its taxes and meet its statutory duties (sanctions against non-compliance are provided by competition and the law).
2. Concern for the direct results of the actions of companies in carrying out their primary task and includes making the most of the community's human resources and avoiding damage to the environment.
3. A much less well-defined area of responsibility, which takes in the interaction between business and society in a wider sense. How far has business a responsibility to maintain the framework of society in which it operates, and how far should business reflect society's priorities rather than its own commercial ones?

Such a "definition", while interesting, doesn't really quantify a company's social responsibilities. In their critical review "against CR" Fougère & Solitander (2009) draw a similar conclusion to Cadbury's first point but in answering how far a business should go socially, they conclude: not very far: "A socially responsible company should be expected to pay taxes in full and let the population decide through its

elected government... where money should be spent in order to best enhance social well-being in the community." (Fougère & Solitander, 2009) Fougère & Solitander distinguish between responsibility, irresponsibility and "aresponsibility", where corporations only choose to protect natural resources, for example, when there are other cheaper resources available – when the company sees no such opportunity, it reverts back to its narrow financial rationale (Fougère & Solitander, 2009).

Garriga & Melé (2004) cite Davis as one of the first to introduce "business power" into the CSR debate – according to Davis, business's social responsibility should be commensurate with its social power (Davis 1960), an important idea given the strong social power of large corporations; meanwhile Clarkson (1995) differentiates between social issues, which will be addressed by the (democratically) elected government; and stakeholder issues which are dealt with by the corporation itself.

3.4.3 ISO standard

As we write, ISO 26000 (ISO, 2006) is being given final approval as a draft standard. ISO 26000 is an interesting document which outlines a standard set of principles for CSR and in this respect gives companies something far more concrete to use in deciding their level of social responsibility. But the ISO standard will not be certifiable, and is only released as a set of guidelines for companies to follow. From a critical perspective, there are many issues behind the development of ISO 26000, not least that it does not follow the strict verifiable management system approach of ISO 9000 or 14001 series. There will be no third-party certification – one reason for this is the dreadful state of third-party verification industry, which would increase the risk to the standard (Castka & Balzarova, 2007).

While many will question the use of a non-certifiable standard, we find ISO26000 useful in outlining the breadth and scope of a company's social responsibility, not least as it moves CSR firmly away from the "environment and community" social work concepts. ISO 26000 outlines seven key areas for companies to focus upon:

- Corporate governance
- Fair labour practices
- Fair operating practices
- Consumer issues
- Community
- Environment; and
- Human Rights.

These are seven useful pillars for any CSR practitioner to abide by; we will examine how space companies follow such guidelines in our benchmarking analysis – to some extent, the ISO 26000 standard incorporated ideas from GRI (Levy, Brown, & de Jong, 2010), our chosen benchmarking tool.

3.5 A scientific lens

In this literature review, we have taken the views of scientists, sociologists, philosophers, astronauts, chief executives, regulators and policymakers. But a true critical study calls for awareness from a number of points of view and we note one is missing – the artist.

As such, we end this literature review with another photograph: Neil Armstrong's first footprint on the moon. We use it for its familiarity and for the presence of a faint artefact so obvious many people, especially scientists, may either not see or just take for granted – the *reseau* grid. Scientists may have never given these grids, a feature of almost every Apollo mission photograph – a second thought. To the scientifically-trained, such grids are as natural as a scale on a map, clearly for measurement and analysis of the photographs, and one would expect such artefacts on Apollo mission photographs. But

should we? San Francisco artist and photographer Michael Light has a very different perspective, which lends itself beautifully to our critical analysis of space travel.

> *"[Through the* reseau-*line grid] the Apollo photographs openly admit the biases and goals of their culture like few other documentary survey images made before or since. Apollo was nothing if not a culture of numbers, numbers moved about with unparalleled precision and competence." (Light, 1999)*

Light's view is perhaps an unusual perspective to a scientist, and one we hope will stimulate further critical thinking in what is "normal". Why, for example, was our first mission to the moon one of numbers and not one of art? Why was photography an afterthought, with the astronauts equipped with chest mounted Hasselblad cameras without even viewfinders (Light, 1999)? Can we imagine a society whose sole aim in visiting the moon would be to capture beautiful paintings, photographs and movies of the lunar surface? Why were we so intent on digging up rocks, samples, measuring, defining? These are interesting questions to ask ourselves, particularly as low cost zero-gravity moves from the realm of science fiction to the realm of the holidaymaker and mankind pushes further into the solar system.

3.6 Chapter conclusion

We have presented a broad critical view of CSR. We have aimed to establish the difficulty of prescribing CSR behaviour, particularly in a new field of commercial space travel. In space, at least in the early stages of space tourism, it seems unlikely corporate

actors will compete on CSR attributes of either their companies or their products and services; and given the lack of rigorous proof that CSR can improve company performance, why would we expect companies in space and space tourism to invest in CSR activities?

Through CSR theory and Jacoby's model we see it is often in the corporations self-interest to engage in a level of CSR. But more work is required to see exactly what form that CSR takes, and what form it will take in the future. We bring ideas about power to the foreground, as we believe these will be crucial ideas in both analysing and prescribing CSR in space going forward.

We ended with an artist's view to bring in another perspective to oft-discussed topics.

This review has raised many points and theories which will be used in our investigation into CSR in space and space tourism, and we now move onto a chapter outlining our methodology.

CHAPTER 4 INVESTIGATION METHODOLOGY

> *The focus of the inquiry was not the managerial 'what?' and 'how?' of the corporate shift to sustainable development, but the ideological conceptions held about the concept and the narratives these construct.*
>
> *(Springett, 2005)*

While our initial aim was to follow the critical path of questioning company attitudes, rather than specific actions, after Springett (2005), we needed first to uncover the 'what?' of actual corporate responsibility behaviour in the industry (Springett 2010). The topic of CSR in space is extremely fresh, and for future work to be able to examine the ideological conceptions held about CSR in space tourism, some groundwork and foundations must first be prepared.

4.1 Research questions and methodology

Our research questions attempt to establish the CSR situation in space tourism – at what stage is CSR in the space and space tourism industry? What are some of the issues, as defined by an earthly understanding of CSR? And, arising from our critical literature review of modern CSR, what are some of the power relationships which need to be understood in order to critically assess CSR now and in the future? How do government and corporations interact in this sphere? What are some of the normative and ethical questions about what corporations *ought* to be doing, viewed from a critical perspective?

Further study into the attitudes and conceptions held by space tourism stakeholders will certainly require direct interviews, company visits, focus group and survey work. But to create a foundation for such future work and to open the topic, we felt a solid understanding was first required into exactly what stage was CSR at in space tourism.

There are many tools available for assessing CSR activity. We may apply case studies, interviews, focus groups, company visits, surveys or empirical company research. For most companies, CSR reporting is the first (and often only) step taken in voluntary corporate responsibility (Fougère & Solitander, 2009), and so it was decided to investigate target companies voluntary reporting as a proxy for actual CSR behaviour.

We decided to undertake a benchmarking study of voluntary CSR reporting in the space industry, a process which would give us the solid understanding of the space tourism CSR position and allow us to examine areas for future critical work, while developing guidelines and recommendations for the industry based on our results.

Space tourism is relatively new, with only one agent, Space Adventures, having brokered tickets to orbital space – we can view Space Adventures as a "travel agent" in this regard. We decided to focus on companies which would be directly responsible for placing people in space – this meant space companies such as SpaceX, Virgin Galactic, Orbital Sciences, which are working on commercial space travel.

There are only a handful of such companies - we decided a CSR benchmarking would have the most value if conducted with a larger sample, and we decided to include upstream space companies. We developed a list of 90 companies that make spacecraft or have components in space ("things in space" was our initially loose criterion), or who

actively consult on space missions or R&D. It is our view that companies with a physical presence in space will be closest to the development of a space society.

Benchmarking CSR simply involves analysing each company for reporting on the chosen CSR or sustainability indicators.

4.2 CSR benchmarking methodology

Benchmarking CSR reporting is a tool used to compare companies CSR activities. Typically a sample is selected; scores are allocated across a range of categories based on publically available information; the results are compiled as league tables or scores used to show which companies are most active in their CSR reporting, either in general or across specific categories. As already stated, CSR reporting is considered a good proxy for CSR behaviour, since for most companies the first CSR activity *is* reporting.

4.2.1 Choice of benchmark and indicators

After Skouloudis *et al* (2009) and Morhardt, Baird, & Freeman (2002) we decided to use an evaluation methodology based on the Global Reporting Initiative (GRI) guidelines. Other methods of evaluating company reporting are available, but we concur with Skouloudis *et al* (2009) that GRI may offer the most consistent and repeatable replicable results. Issues regarding GRI's development as a "triple bottom line" reporting tool, and its stagnant uptake (Levy, Brown, & de Jong, 2010) do not diminish the value of its indicator sets.

The broad categories of indicators are given in Table 3 below.

Table 3: Benchmarking indicator categories

Indicator	Max score	% of total score
Strategy analysis	8	1.6%
Organisational profile	40	7.8%
Report parameters	52	10.2%
Governance	68	13.3%
Economic	36	7.0%
Environmental	120	23.4%
Social: labour	56	10.9%
Social: human rights	36	7.0%
Social: society	32	6.3%
Social: product	36	7.0%
Space	28	5.5%
Total	512	100%

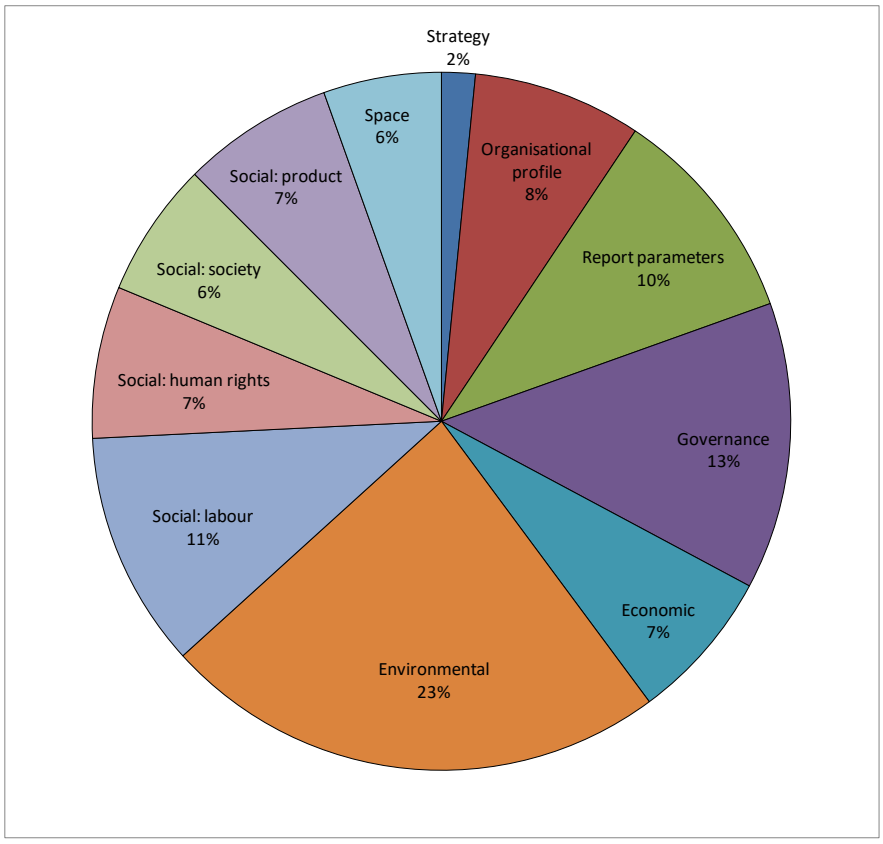

Figure 1: Benchmarking category weights

4.2.2 Sample selection

Our space operator list was compiled from four sources: Dickens & Ormrod (2007, p193); a list of exhibitors at the 26th National Space Symposium, held in Colorado April 2010 (National Space Symposium, 2010); and a list of 47 members of European space systems of launch service association Eurospace (Eurospace, nd). We also used the 2010 Roberts Environmental Center report into leading aerospace companies (Roberts Environmental Center, 2010).

After removing publications, pure downstream services, associations, government bodies, educational institutions[9], companies focussed only on aviation and aeronautics and merging and de-duplicating we stood at 90 companies to study in more depth. The list is found in Appendix A.

4.2.3 Developing new benchmark indicators and categories for space

While we took G3 (GRI, 2006a) indicators as our baseline, we developed a new supplement for the upstream space sector based on the issues highlighted by our literature review and using the transport and logistics supplement (GRI, 2006b) as our foundation.

Our space supplement is shown in Table 4; while the complete list of 121 indicators is shown in Appendix B.

Table 4: "Space Supplement" indicators for space operations

1. Organizational space profile

[9] All of these would be very interesting to study, from a social responsibility point of view, but this survey is focused on corporate behavior of commercial space companies

SP1	Number of spacecraft controlled by the reporting organisation, including how many presently underway
SP2	Number/details of hardware in operation, underway now or in the past in space
2. Environmental	
SP3	Recognition of environmental and social issues in space, and the company's role in this sphere
SP4	Description of policies and programmes on the management of environmental impacts in space: space debris; planetary contamination
SP5	Description of environmental impacts of the reporting organisation's major space-based infrastructure assets. Report the results of environmental impact assessments.
SP6	External Codes of conduct or international space agreements adhered to, eg COUPOUS, certifications
3. Social	
SP7	Crew safety issues and vehicle reliability

4.2.4 Benchmarking process in detail

Where companies published a dedicated report, we took this as our source. Where companies published no separate CR report but published an annual report, we would use this together with web information.

For companies without either an annual or dedicated CR report, we used general website information – qualifying information must have been on a distinct web page (s) (eg marked "corporate responsibility" "environment" "sustainable development" 'social responsibility" "corporate governance" "ethics".) If there was no such obvious page (s) accessible directly from the home page or under a second-tier menu item such as "about

us" or "more information" or "company" tabs, we would not look any deeper. Sections such as "media" were ignored.

4.2.5 Scoring

For each indicator, we gave a company a score of 0-4, as outlined in Table 5 below. Scoring is subjective, although with a single researcher conducting the scoring it is consistent. For future reference, we recorded the location (either report and page number or direct web link) of each item.

Table 5: Rating scale for CSR benchmarking indicator scoring

Score	Rating qualification
0	The report does not include any information
1	The report includes generic or vague statements
2	The report includes valuable information on the topic
3	The report contains detailed information on the topic
4	The coverage can be called "full", providing policy, procedures and it is clear the organisation has procedures in place to measure, collect and present this information

After (Skouloudis, Evangelinos, & Kourmousis, 2009)

4.3 Empirical examination

The benchmarking exercise provided a wealth of information. Guided by the results, we chose six companies to pull out as more detailed "cross-section" study. We use this forum to analyse the relationships between the companies and government, as appropriate; consider the historical development of social structures and processes.

4.4 Discussion of methodology

4.4.1 Use with caution

> *"It is still distressingly common to see [CSR] scales cobbled together by assembling an arbitrary group of statements which sound as if they would be relevant, with similar 'off the top of the head' ratings assigned to different answers and simple addition of these ratings to obtain some mystical score" Robson 1993, cited in (Jones & Alabaster, 1999)*

Benchmarking CSR is a relatively new field and problematic. Converting CSR reporting activity into subjective scores is ambiguous enough, but add inappropriate and misguided statistical analysis techniques into the methodology and the field is beset with flaws.

The measurement of CSR in space presents yet more issues. First, there is no accepted literature on what constitutes "good" CSR in space, and therefore a traditional benchmarking, designed for terrestrial company operation, may miss crucial relationships and factors.

Second, our early reconnaissance of the industry led us to believe that some of the main players in space tourism were in fact small private companies – and smaller private companies score less well in traditional CSR benchmarking than larger listed companies (need a source, sure to find one). As a result, traditional benchmarking techniques (which tend to look at large listed companies) may lead us to conclude that CSR is at a poorer stage in space tourism than it actually is.

Yet for all its issues, benchmarking CSR reporting is a powerful tool in researching CSR status of companies. It is possible to undertake a comprehensive benchmarking without

direct company contact, interviews or visits; the process itself gives the researcher a strong qualitative feel for the sector or sample CSR activities; and if used responsibly, the results can highlight areas for further research and perhaps "gaps" in CSR reporting which may otherwise go unnoticed.

As Graafland et al (2004) point out, benchmarking CSR is highly criticised because it tends to disregard the complexity of measuring responsible behaviour. CSR is highly pluralistic and as such should not be reduced to one single cardinal number (following Graafland, Hurka and Van Perperstraten) Graafland cites Krut and Munis (1998) who claim reporting CSR achievements with numbers is inappropriate – Krut and Munis use typographical symbols in their environmental performance monitoring for example. However, we find such methods make for extremely unwieldy results. Results presentations such as this come at the expense of deriving clear conclusions (Graafland, Eijffinger, & Smid, 2004). On the other hand, totting up cross-category scores and presenting a "league table", which is great for public consumption, is equally problematic. Presenting just final scores on GRI benchmarking is ambiguous since a particular score can be achieved in very different ways (Morhardt, Baird, & Freeman, 2002). Jones and Alabaster (Jones & Alabaster, 1999) cite Robson 1993 who notes it is "still distressingly common to see scales cobbled together by assembling an arbitrary group of statements which sound as if they would be relevant, with similar 'off the top of the hear' ratings assigned to different answers and simple addition of these ratings to obtain some mystical score."

Jones (p55) cites Miles and Huberman that researchers may have data overload. "It is therefore not surprising that many researchers prefer working with numbers alone, or

getting the words they collected translated into numbers as quickly as possible, write Miles and Huberman – and their comments ring true in this case. Certainly in a perfect world, we would like to be able translate 90 companies CSR reporting, annual reports, governance guidelines and code of ethics and thousands of web-pages into a single set of numbers, perhaps even just one neat number[10].

The trick is negotiating the trade-off between ease-of-consumption of results and validity of results.

The point is particularly important in our study of space companies, since we have not seen benchmarking in this sector, to this degree of resolution before. Inappropriate benchmarking such as Robson (1993) decries may lead to companies with high scores falling into a false sense of security and gaining unwarranted positive publicity, or companies with poor scores receiving unfair negative publicity (Jones & Alabaster, 1999).

Furthermore we must take care when using statistical analysis to compare the results. After Jones (1999) (Jones & Alabaster, 1999) we agree that labels may just as well be used as numerical codes – an overall "average" or even median across all categories is meaningless.

[10] Could it be this desire which Douglas Adams was poking fun at with his "answer" to the universe being "42" (Adams, 1981)?

As Graafland et al (2004), we do not believe addition of scores across small distinct categories gives rise to major mathematical or statistical flaws, but we concur with Jones (1999) that the “total” score should be used with extreme caution.

CHAPTER 5 BENCHMARKING RESULTS AND DISCUSSION

In this chapter we present the results of the CSR reporting benchmarking, together with an analysis and discussion of the results. Using the results as a guide, we select a cross-section of companies for more detailed discussion, examining not only the individual companies but a brief study of their interactions with government and regulators.

5.1 Results

5.1.1 Total scores

The 90 companies in our benchmarking study scored total scores of between 10 points to 418, out of a maximum 512 and a minimum of zero[11]. See Figure 2 for a graphical presentation of the total scores for all companies benchmarked.

The median total score was 6.3% of the maximum score possible; listed companies (N=30) showed a median of 21.4%, while for unlisted companies (N=60) the median was 4.6%. Listed companies dominated the top of the list, with only one non-listed company (TNO) appearing in the top 20. Geographically, US (N=56) or Canadian (N=2) companies scored 5.4% median score, and Europe (N=32) 9.0%. We will draw no conclusions from this, noting the disparity is most likely due to our sample bias towards smaller US companies from our US-exhibition list.

[11] Although it would be hard to score zero: companies scored four points for reporting their name; and four points for their headquarters location.

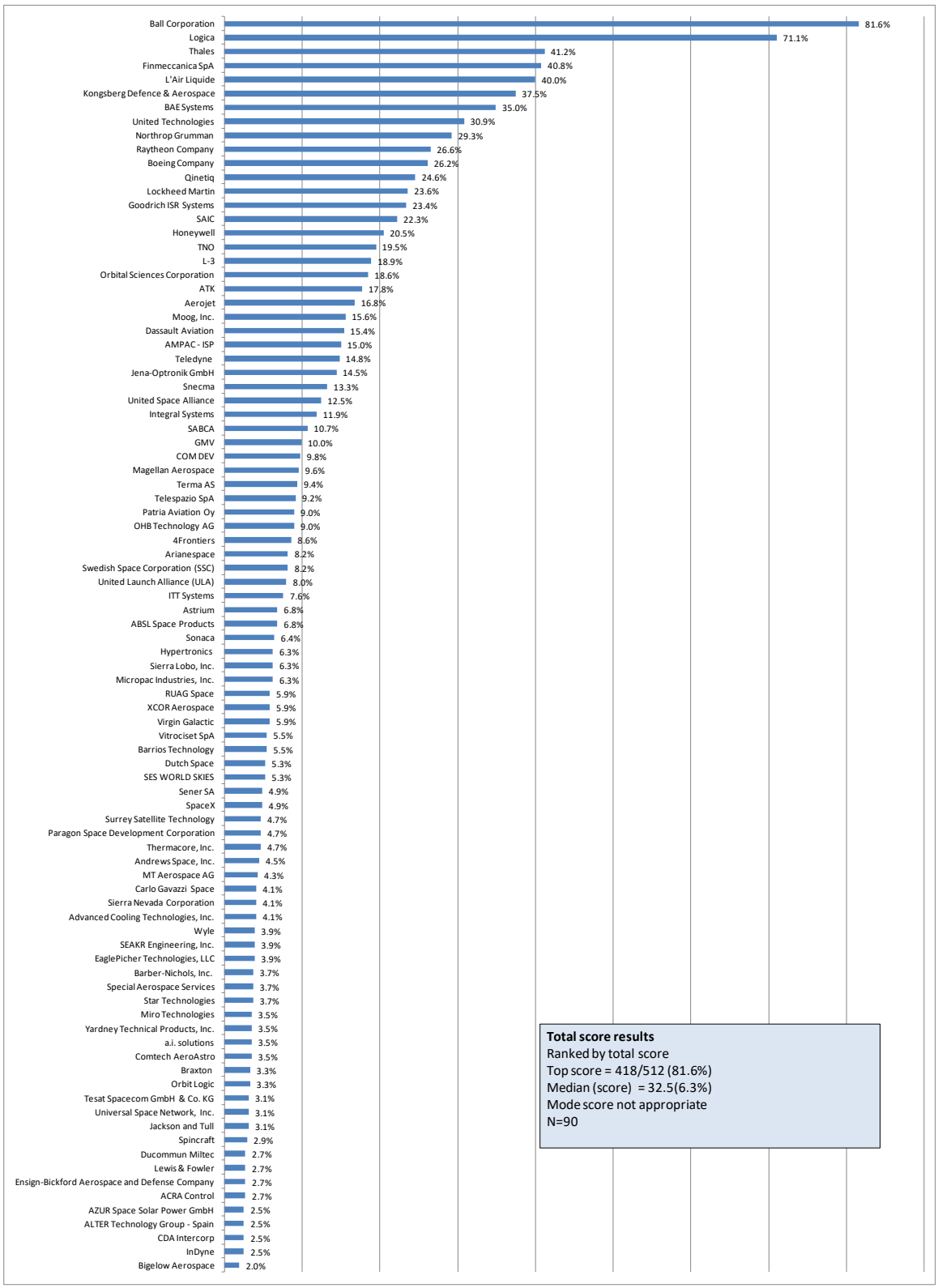

Figure 2: Total scores (percentages)

Table 6: Median percentage scores

Sample	Median score (% of maximum)
All (N=90)	6.3%
Listed (N=30)	21.4%
Unlisted (N=60)	4.6%
Europe (N=32)	9.0%
North America (N=58)	5.4%

Table 7: Top ten scoring companies

Rank	Company	Listed	Approx revenues/m[12]	Location	Total score
1	Ball Corporation	NYSE	$7,300	CO, US	418
2	Logica	London Euronext	$3,600	UK	364
3	Thales	NYSE Euronext Paris	$18,060	France	211
4	Finmeccanica	Italy	$39,620	Italy	209
5	L'Air Liquide	Paris Euronext	$16,800	France	205
6	Kongsberg Defence & Aerospace	Oslo	$1,800	Norway	192
7	BAE Systems	London	$36,200	UK	179
8	United Technologies	NYSE:	$12,580	CT, US	158
9	Northrop Grumman	NYSE	$33,700	CA, US	150
10	Raytheon Company	NYSE	$24,900	MA, US	136

5.1.2 Category results

The following pages present the company scores for each category (Table 8), ranked by total overall score, and with the top 10% scores in each category highlighted. The following figures show graphical representations of the percentage scores by Governance,

[12] 2009

Environmental, Social, Economic and Space categories. For the social category, we group the four "social" categories, Labour, Human Rights, Society and Product, together for ease of presentation. We also present a breakdown of category scores graphically, for listed companies only. The chart is too complex to display all companies.

Table 8: Category scores

Rank	Company	Strategy	Org profile	Report	Governance	Economic	Environmental	Social: labour	Social: human rights	Social: society	Social: product	Space
1	Ball Corporation	8	40	52	68	28	68	56	28	32	36	2
2	Logica	8	40	52	68	36	71	38	17	22	12	0
3	Thales	8	36	8	49	12	67	7	11	11	1	1
4	Finmeccanica SpA	6	34	36	42	16	62	4	4	3	2	0
5	L'Air Liquide	6	27	32	39	15	50	28	1	3	3	1
6	Kongsberg Defence & Aerospace	2	36	29	35	17	25	15	19	12	1	1
7	BAE Systems	8	33	26	52	9	16	10	0	25	0	0
8	United Technologies	8	31	0	41	15	17	16	11	15	2	2
9	Northrop Grumman	8	35	15	29	15	19	13	6	8	0	2
10	Raytheon Company	5	33	1	42	6	26	14	2	6	0	1
11	Boeing Company	8	26	0	38	12	38	5	0	2	1	4
12	Qinetiq	5	29	0	47	11	13	9	0	8	1	3
13	Lockheed Martin	6	34	0	24	10	22	4	0	15	2	4
14	Goodrich ISR Systems	8	27	1	33	8	16	16	0	9	1	1
15	SAIC	5	29	0	38	16	10	4	1	9	1	1
16	Honeywell	4	36	0	37	10	4	4	3	6	0	1
17	TNO	8	23	20	10	7	15	15	0	0	0	2
18	L-3	2	24	0	40	7	0	11	1	9	3	0
19	Orbital Sciences Corporation	0	25	0	33	7	0	5	0	13	2	10
20	ATK	4	31	0	34	9	7	4	0	1	0	1
21	Aerojet	8	32	0	8	12	17	4	0	3	0	2
22	Moog, Inc.	2	30	0	31	7	2	0	0	0	0	8
23	Dassault Aviation	8	27	0	8	6	28	0	0	0	0	2
24	AMPAC - ISP	3	26	0	26	11	2	4	0	1	3	1
25	Teledyne	1	26	0	31	11	1	2	0	4	0	0
26	Jena-Optronik GmbH	0	32	0	20	9	0	10	0	0	0	3
27	Snecma	2	25	0	16	2	12	2	0	4	4	1
28	United Space Alliance	5	21	0	12	2	1	13	1	8	0	1
29	Integral Systems	2	26	0	24	4	0	5	0	0	0	0
30	SABCA	4	27	0	11	5	4	3	0	0	0	1
31	GMV	4	29	0	12	1	3	0	0	2	0	0
32	COM DEV	0	30	0	10	9	0	0	0	0	0	1
33	Magellan Aerospace	0	21	0	19	6	0	0	0	0	0	3
34	Terma AS	0	29	0	13	5	0	0	0	0	0	1
35	Telespazio SpA	1	24	0	15	1	0	1	0	5	0	0
36	Patria Aviation Oy	2	27	0	12	3	0	2	0	0	0	0
36	OHB Technology AG	0	25	0	13	4	0	2	0	0	0	2
38	4Frontiers	7	19	0	9	0	0	2	0	0	0	7
39	Arianespace	2	28	0	3	1	2	1	0	0	0	5

Rank	Company	Strategy	Org profile	Report	Governance	Economic	Environmental	Social: labour	Social: human rights	Social: society	Social: product	Space
39	Swedish Space Corporation (SSC)	2	24	4	2	4	0	0	0	0	0	6
41	United Launch Alliance (ULA)	0	20	0	8	0	0	2	0	7	0	4
42	ITT Systems	3	27	0	4	0	4	0	0	0	0	1
43	Astrium	0	20	0	2	4	0	0	0	0	0	9
43	ABSL Space Products	0	22	0	10	0	0	0	0	0	0	3
45	Sonaca	0	25	0	2	2	2	0	0	0	0	2
46	Hypertronics	3	19	0	7	0	0	0	0	0	0	3
46	Sierra Lobo, Inc.	1	26	0	1	0	0	1	0	1	1	1
46	Micropac Industries, Inc.	0	26	0	4	1	0	0	0	0	0	1
49	RUAG Space	1	23	0	1	0	2	1	0	1	0	1
49	XCOR Aerospace	0	17	0	4	0	0	1	0	5	0	3
49	Virgin Galactic	2	8	0	1	2	9	0	0	1	0	7
52	Vitrociset SpA	0	16	0	11	0	0	1	0	0	0	0
52	Barrios Technology	1	25	0	2	0	0	0	0	0	0	0
54	Dutch Space	0	21	0	4	1	0	0	0	0	0	1
54	SES WORLD SKIES	0	23	0	0	0	0	0	0	0	0	4
56	Sener SA	2	13	0	3	2	3	0	0	0	1	1
56	SpaceX	0	18	0	0	1	0	1	0	0	0	5
58	Surrey Satellite Technology	0	12	0	0	5	0	0	0	2	0	5
58	Paragon Space Development Corporation	1	17	0	5	0	0	0	0	0	0	1
58	Thermacore, Inc.	0	19	0	5	0	0	0	0	0	0	0
61	Andrews Space, Inc.	0	16	0	1	2	0	2	0	0	0	2
62	MT Aerospace AG	0	19	0	2	0	0	0	0	0	0	1
63	Carlo Gavazzi Space	0	16	0	4	1	0	0	0	0	0	0
63	Sierra Nevada Corporation	0	20	0	0	0	0	0	0	0	0	1
63	Advanced Cooling Technologies, Inc.	0	14	0	6	0	0	1	0	0	0	0
66	Wyle	0	16	0	2	0	0	1	0	0	0	1
66	SEAKR Engineering, Inc.	0	13	0	1	4	0	0	0	1	0	1
66	EaglePicher Technologies, LLC	0	19	0	1	0	0	0	0	0	0	0
69	Barber-Nichols, Inc.	0	16	0	3	0	0	0	0	0	0	0
69	Special Aerospace Services	1	14	0	0	0	0	0	0	0	2	2
69	Star Technologies	0	18	0	0	0	0	0	0	0	0	1
72	Miro Technologies	0	17	0	0	0	0	0	0	0	0	1
72	Yardney Technical Products, Inc.	0	12	0	3	0	0	0	0	0	0	3
72	a.i. solutions	0	13	0	0	2	0	2	0	0	1	0
72	Comtech AeroAstro	0	18	0	0	0	0	0	0	0	0	0
76	Braxton	0	14	0	3	0	0	0	0	0	0	0
76	Orbit Logic	0	16	0	0	0	0	0	0	0	0	1
78	Tesat Spacecom GmbH & Co. KG	0	13	0	0	0	0	1	0	0	0	2
78	Universal Space Network, Inc.	0	14	0	2	0	0	0	0	0	0	0
78	Jackson and Tull	0	14	0	1	1	0	0	0	0	0	0
81	Spincraft	0	12	0	2	0	0	0	0	0	0	1
82	Ducommun Miltec	0	14	0	0	0	0	0	0	0	0	0
82	Lewis & Fowler	0	13	0	0	0	0	0	0	0	0	1
82	Ensign-Bickford Aerospace and Defense Company	0	10	0	4	0	0	0	0	0	0	0
82	ACRA Control	0	13	0	1	0	0	0	0	0	0	0
86	AZUR Space Solar Power GmbH	0	10	0	2	0	0	0	0	0	0	1
86	ALTER Technology Group - Spain	0	11	0	2	0	0	0	0	0	0	0
86	CDA Intercorp	0	12	0	1	0	0	0	0	0	0	0
86	InDyne	0	12	0	1	0	0	0	0	0	0	0
90	Bigelow Aerospace	0	8	0	0	0	0	0	0	0	0	2

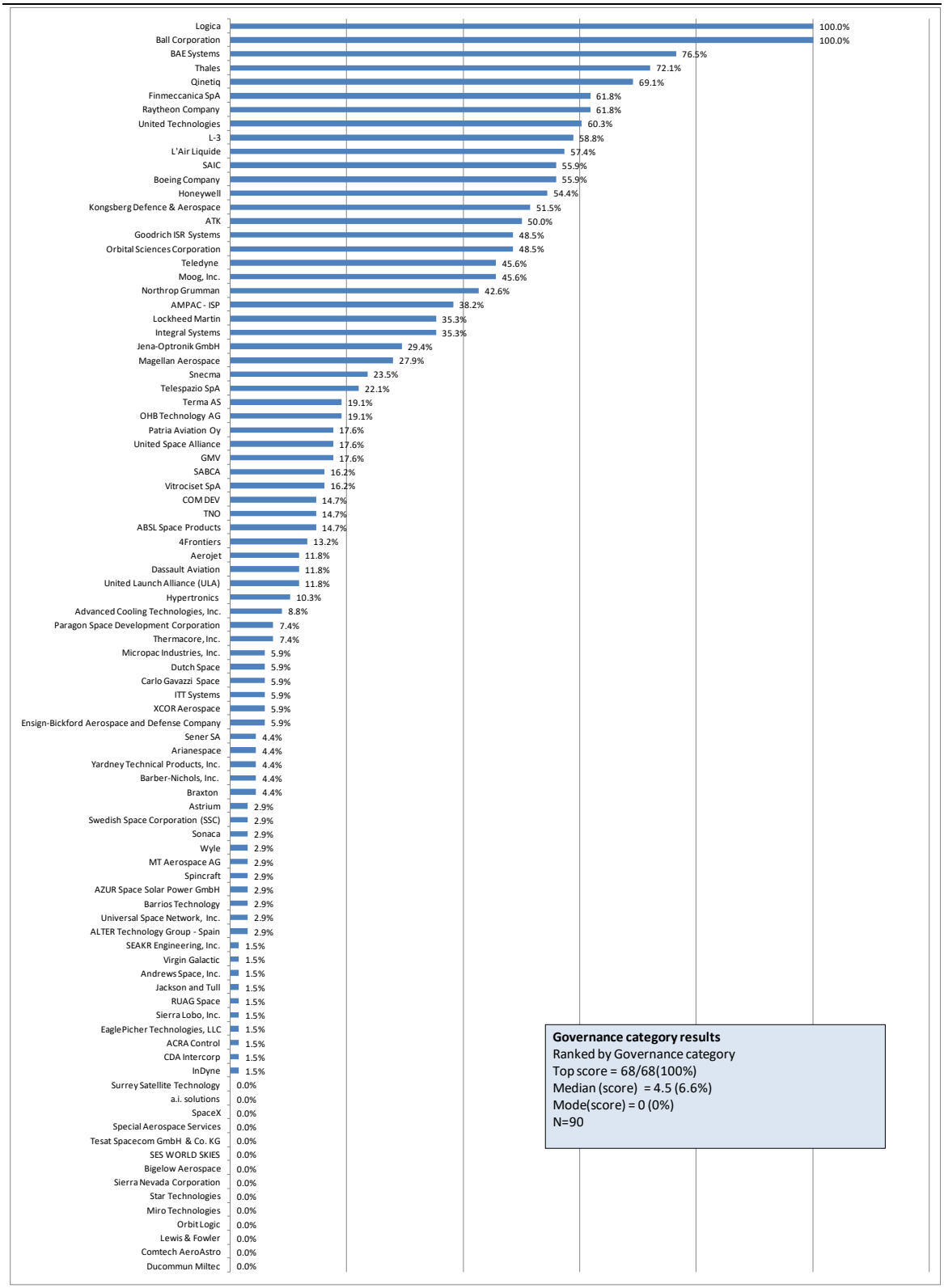

Figure 3: Governance category results

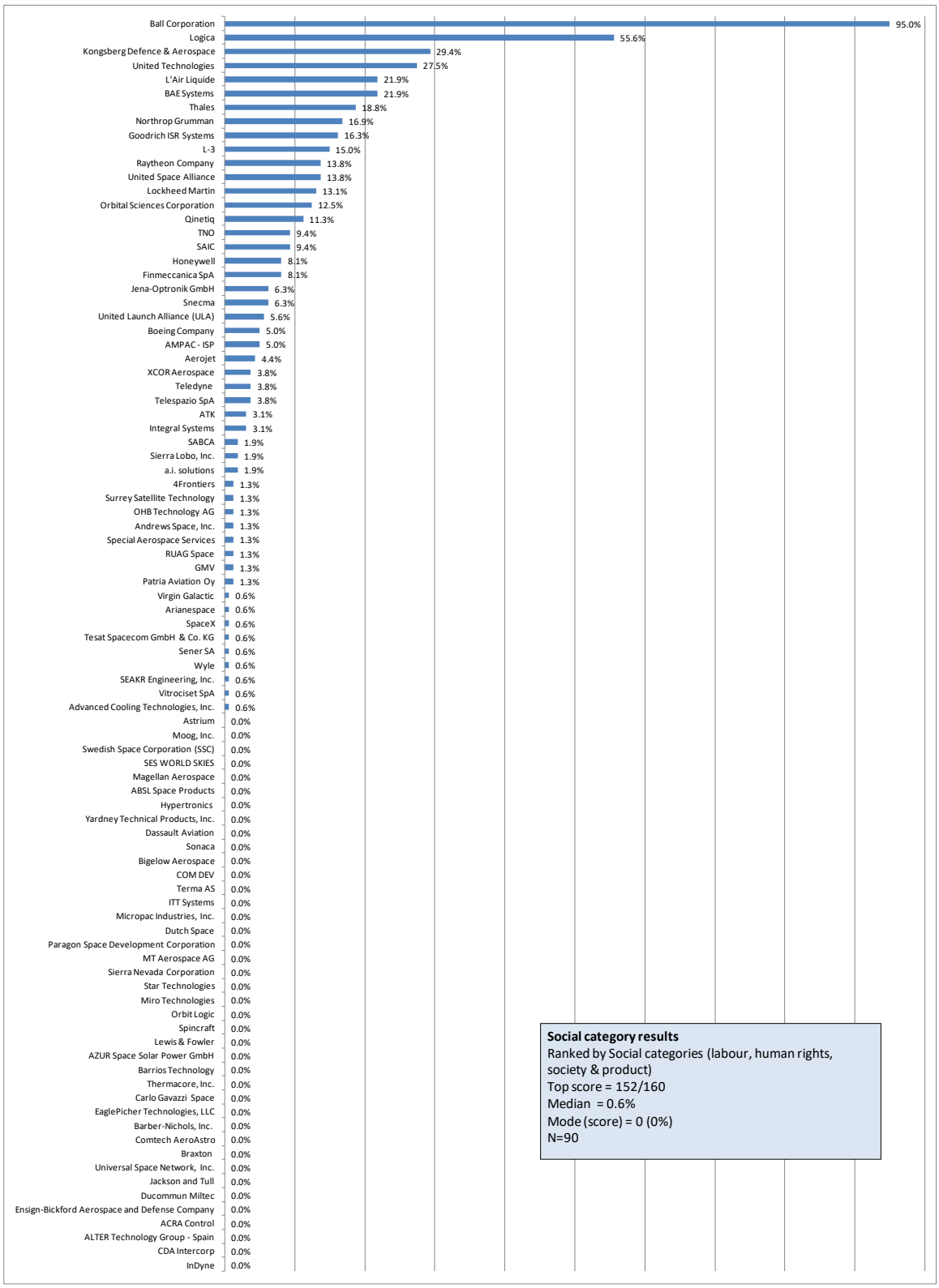

Figure 4: Social category results

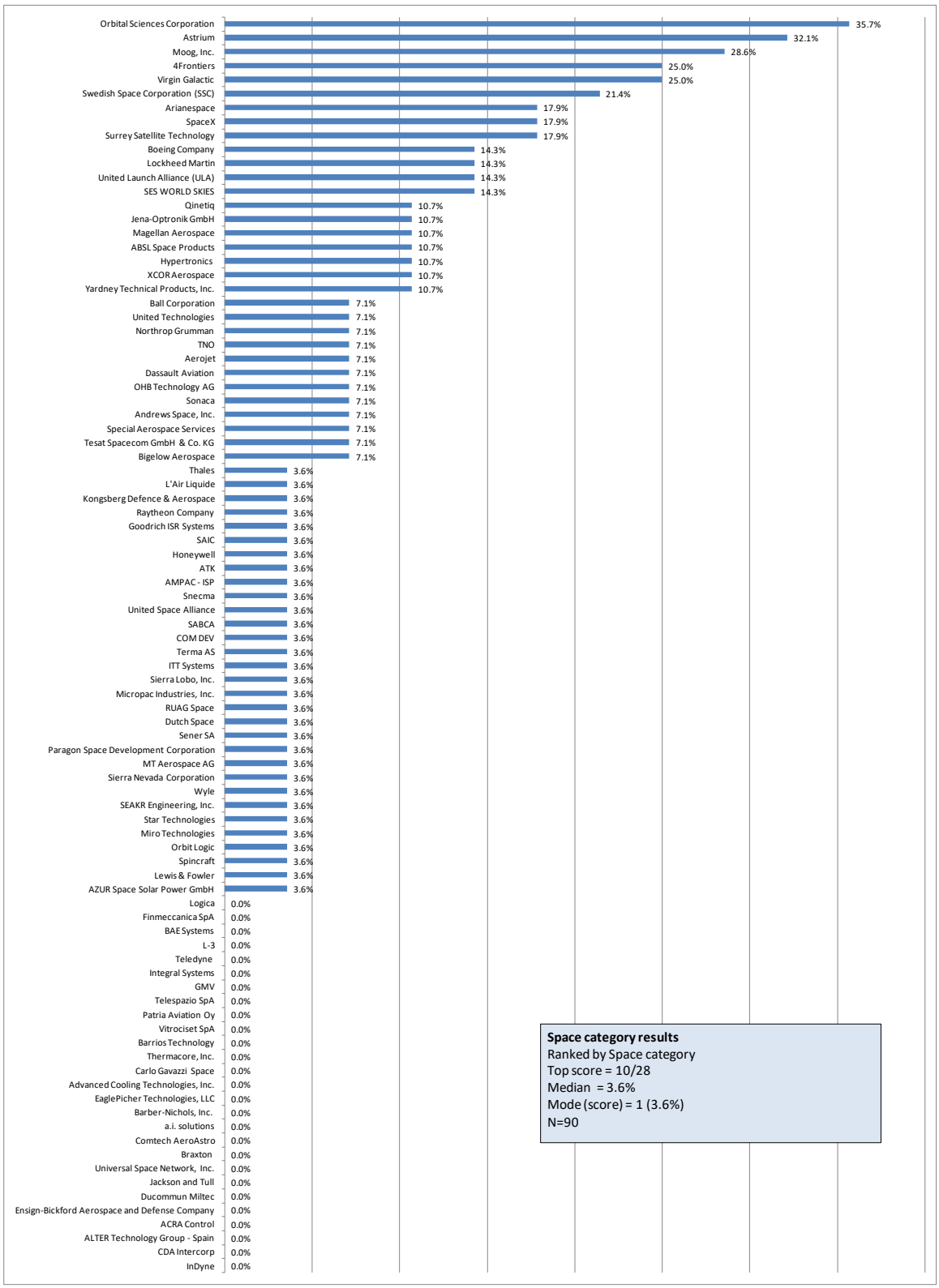

Figure 5: Space category results

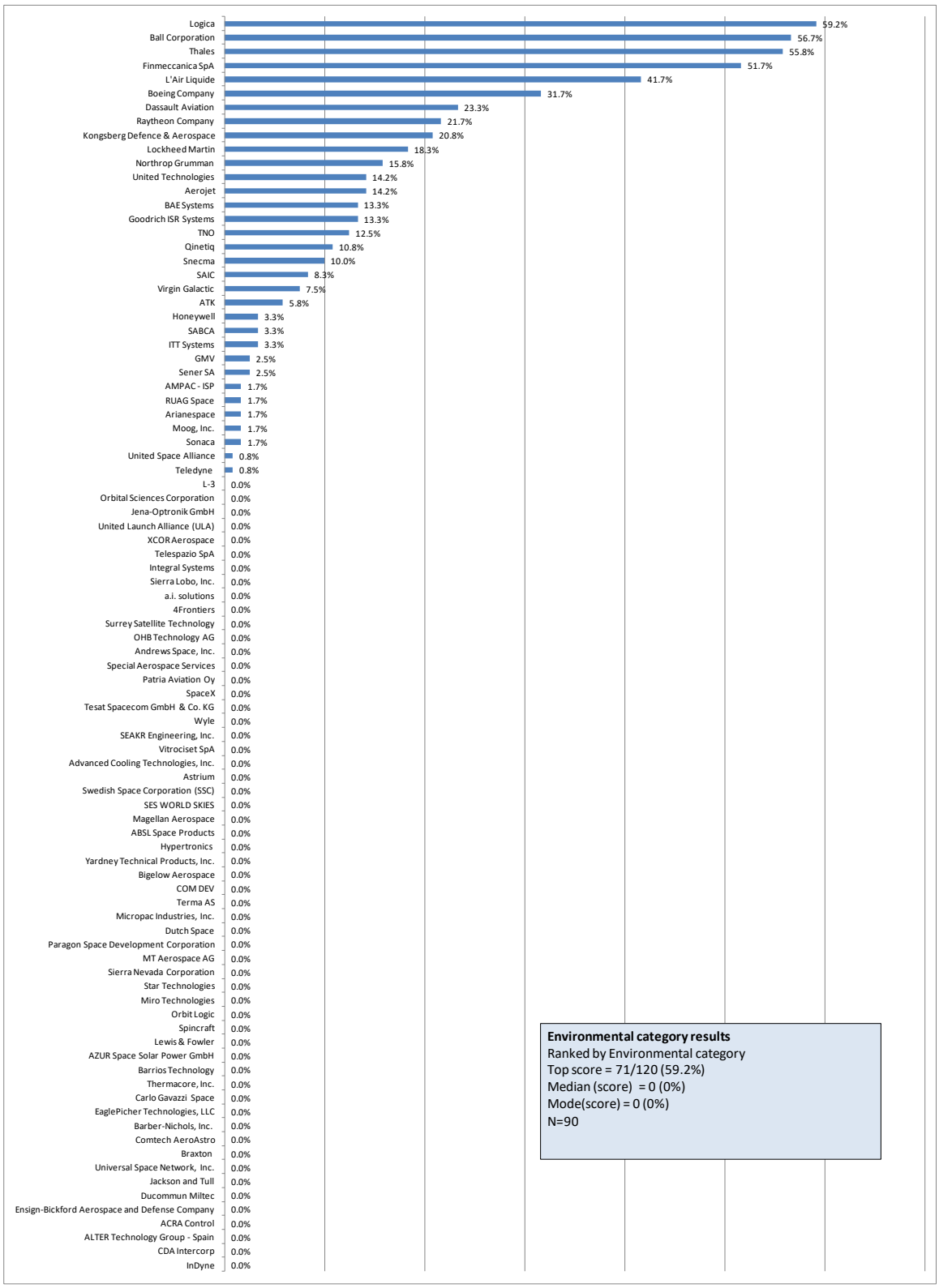

Figure 6: Environmental category results

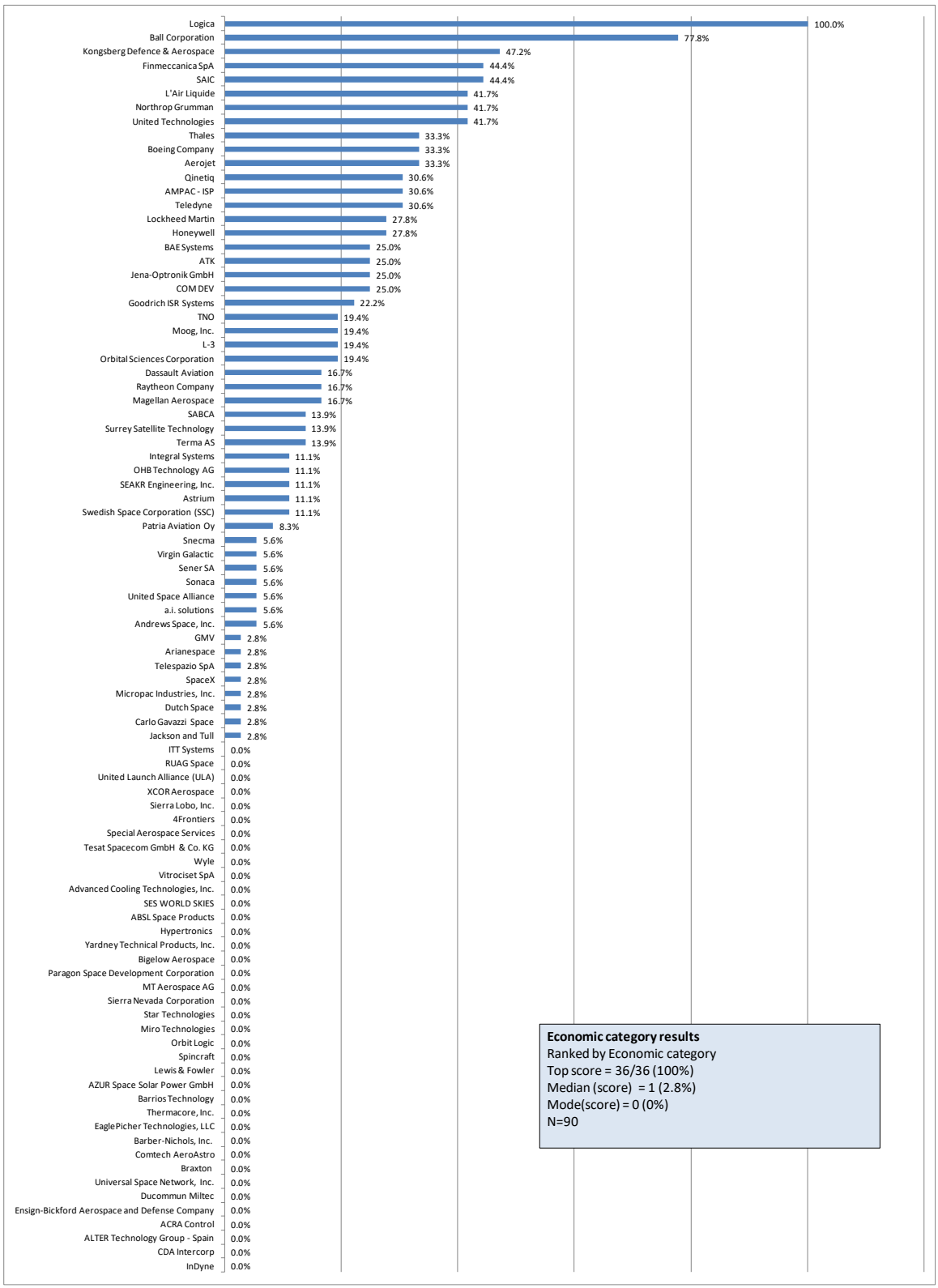

Figure 7: Economic category Scores

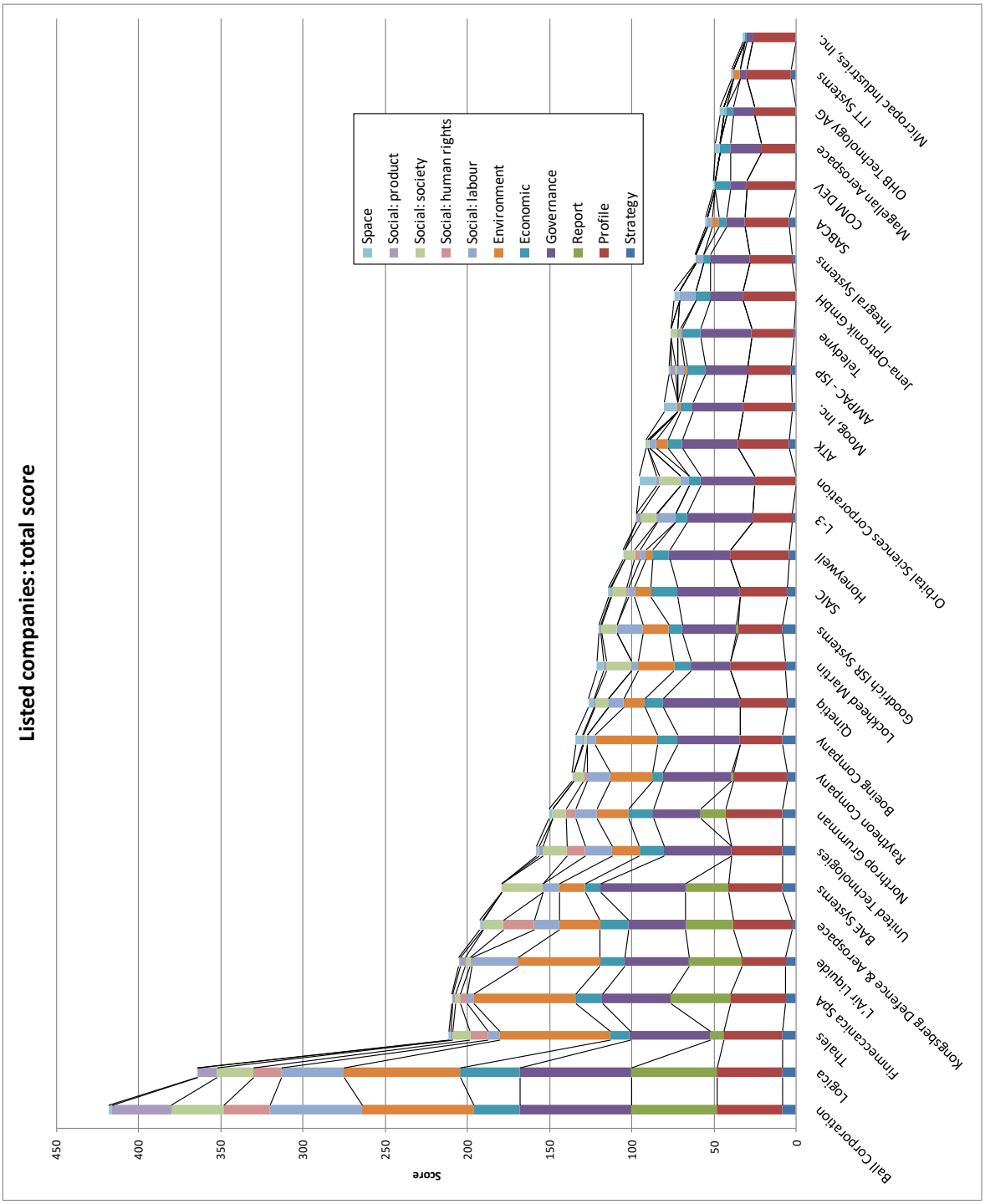

Figure 8: Listed companies total score with category breakdown

Tabulating the scores across all categories, in order of overall ranking, with the top 10% scorers in each category highlighted, as in Table 8, a visual feature immediately stands out[13] – companies scoring well in the "space" section are not the same as those scoring well in all the other sections. The table is too complex to present here, so we show the idea graphically (Figure 9). The bars represent the spread of overall ranking positions that the top 10% scores in each category occupy: 1-10 for rank, of course.

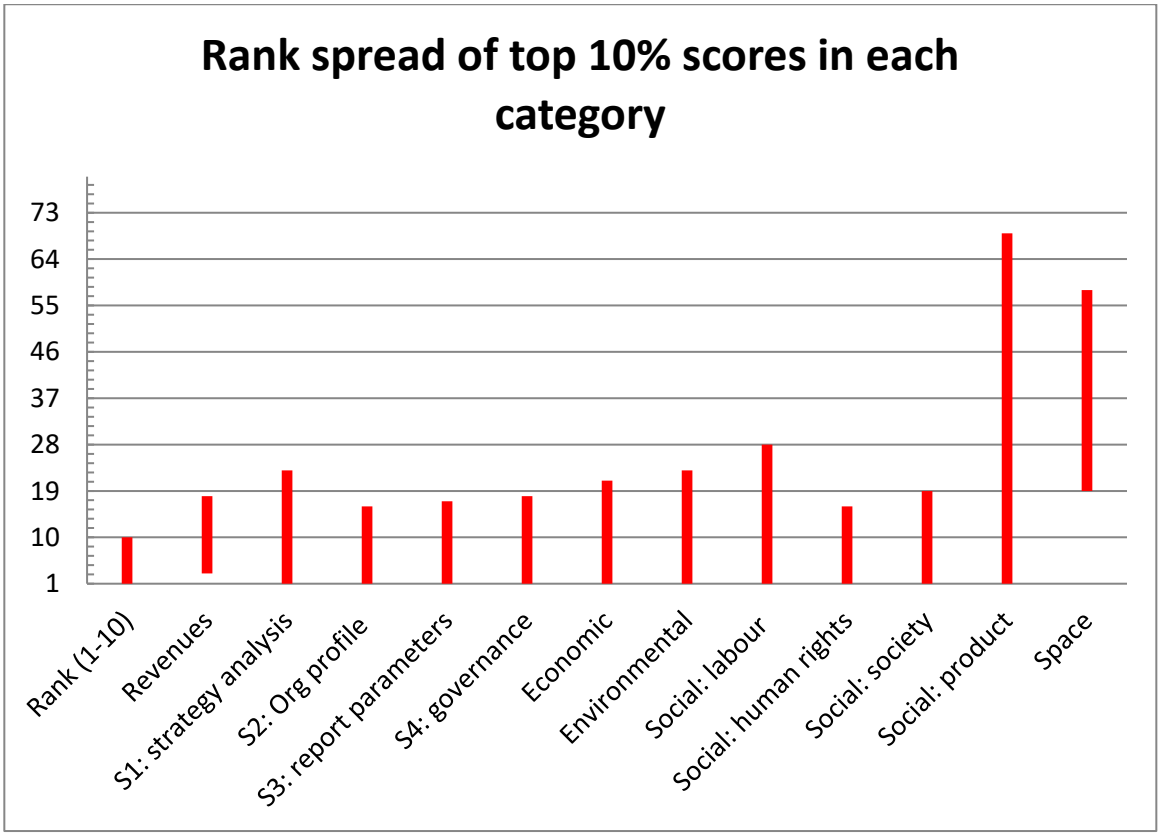

Figure 9: "Rank spread"

[13] This effect is much clearer when viewed on an Excel screen, zoomed out to fit all the data on one screen – for the purpose of fitting the table into this report, the visual effect is less obvious.

We might expect the “rank spread” to be larger for our new category not covered formally by GRI yet. But what is unexpected is what we will call the “lift off” of the space rank spread – the top 10% fall almost entirely below the top 10% in total ranking, and in most other categories. This will be examined further in the discussion.

Figure 10 is a scatter plot which aims to show the same idea. Total score is plotted against each individual category score. Here, we are showing individual category performance against overall performance. Using Excel 2007 to fit a simple linear trend line to each series shows a positive correlation between total score and category score, ie companies which perform better overall can be expected to perform better in each individual category – a company which scores better overall can be expected to score higher in the environmental category than a company which has a lower total score). For the space category only, the pattern does not hold, with a flat line.

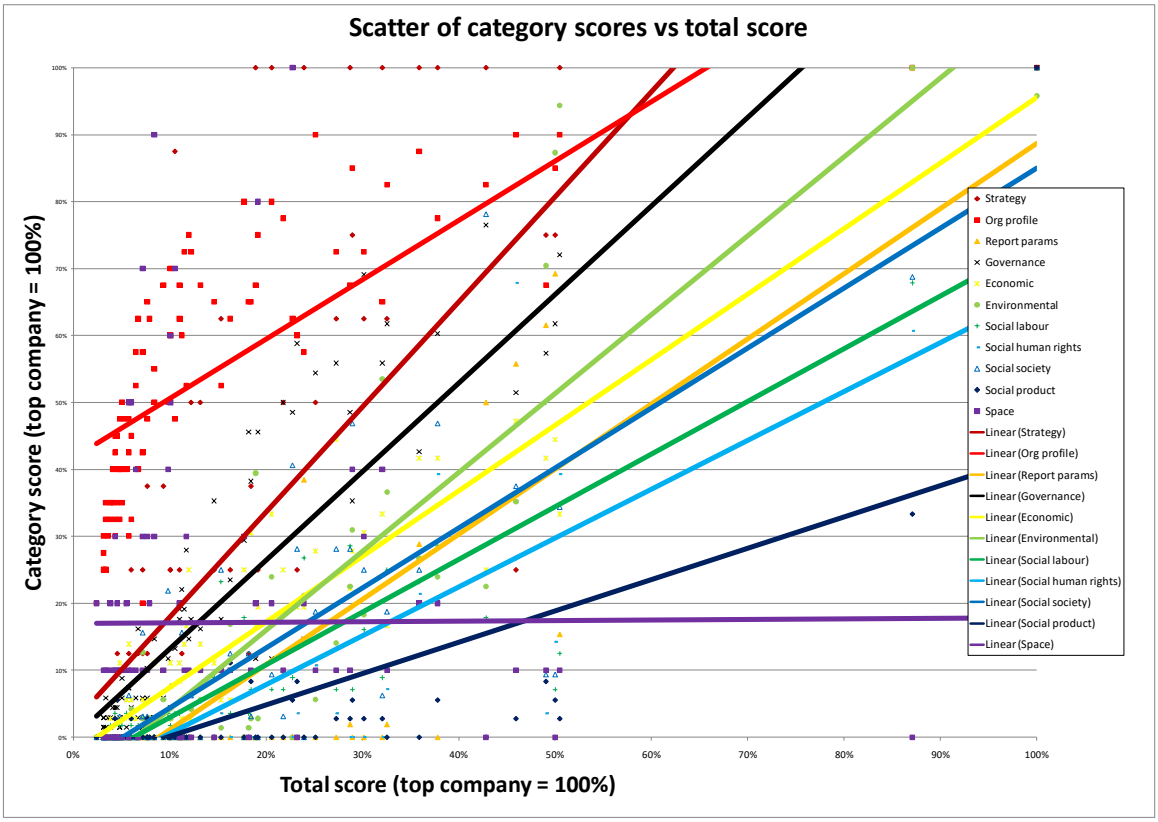

Figure 10: Correlation of category scores to total score

This scatter plot should be used as a guideline only, since we believe even simple regression calculations are not entirely inappropriate for ordinal score data (as discussed in the methodology). However, pairing categories graphically shows how companies performing well in one category perform in another shows a similar result. In the following figures, we pair Total with Social, Total with Environment and Total with Space.

In our discussion we offer some ideas as to why space category scores may stand alone from “terrestrial” CSR in this way.

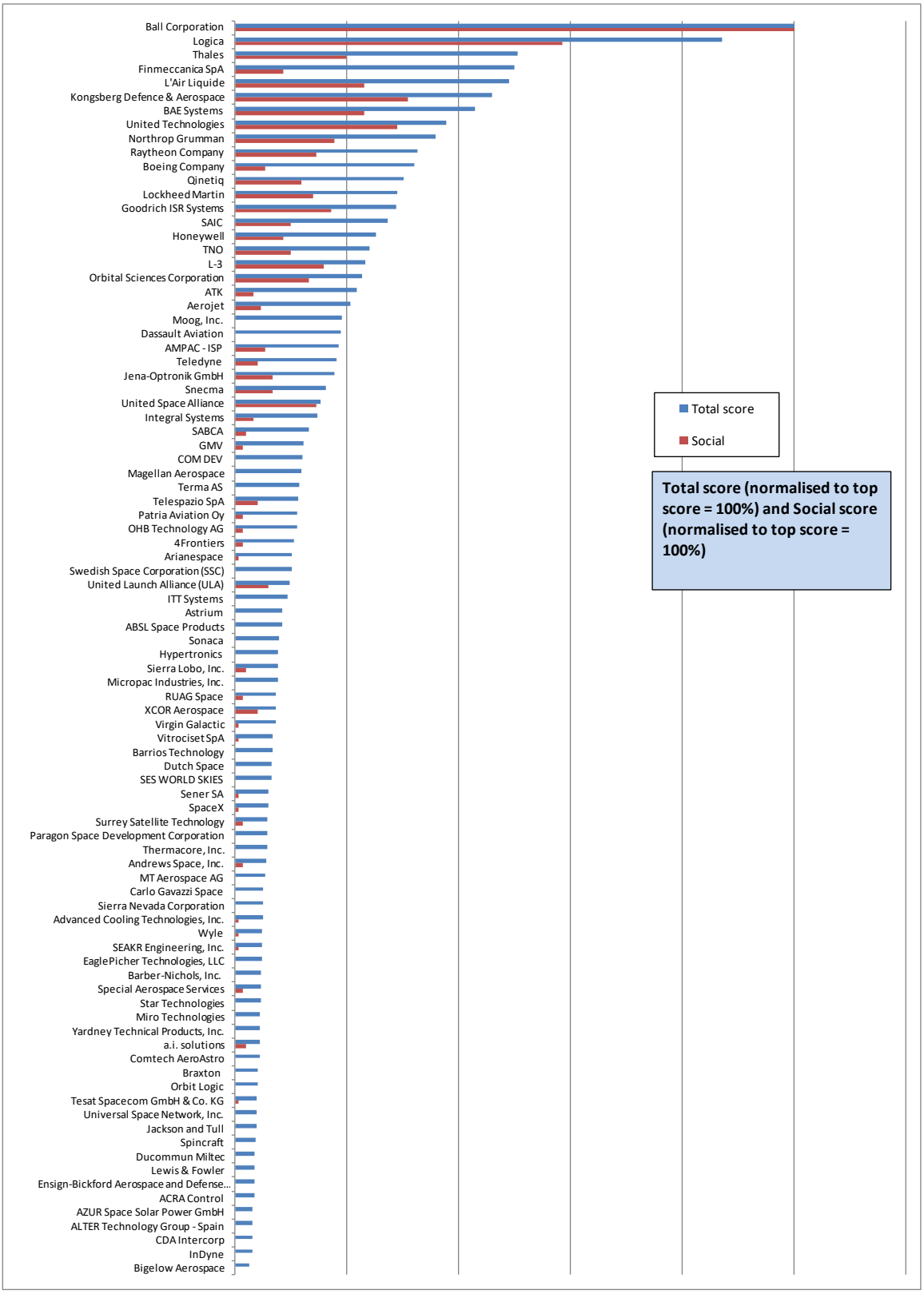

Figure 11: Total score and Social score

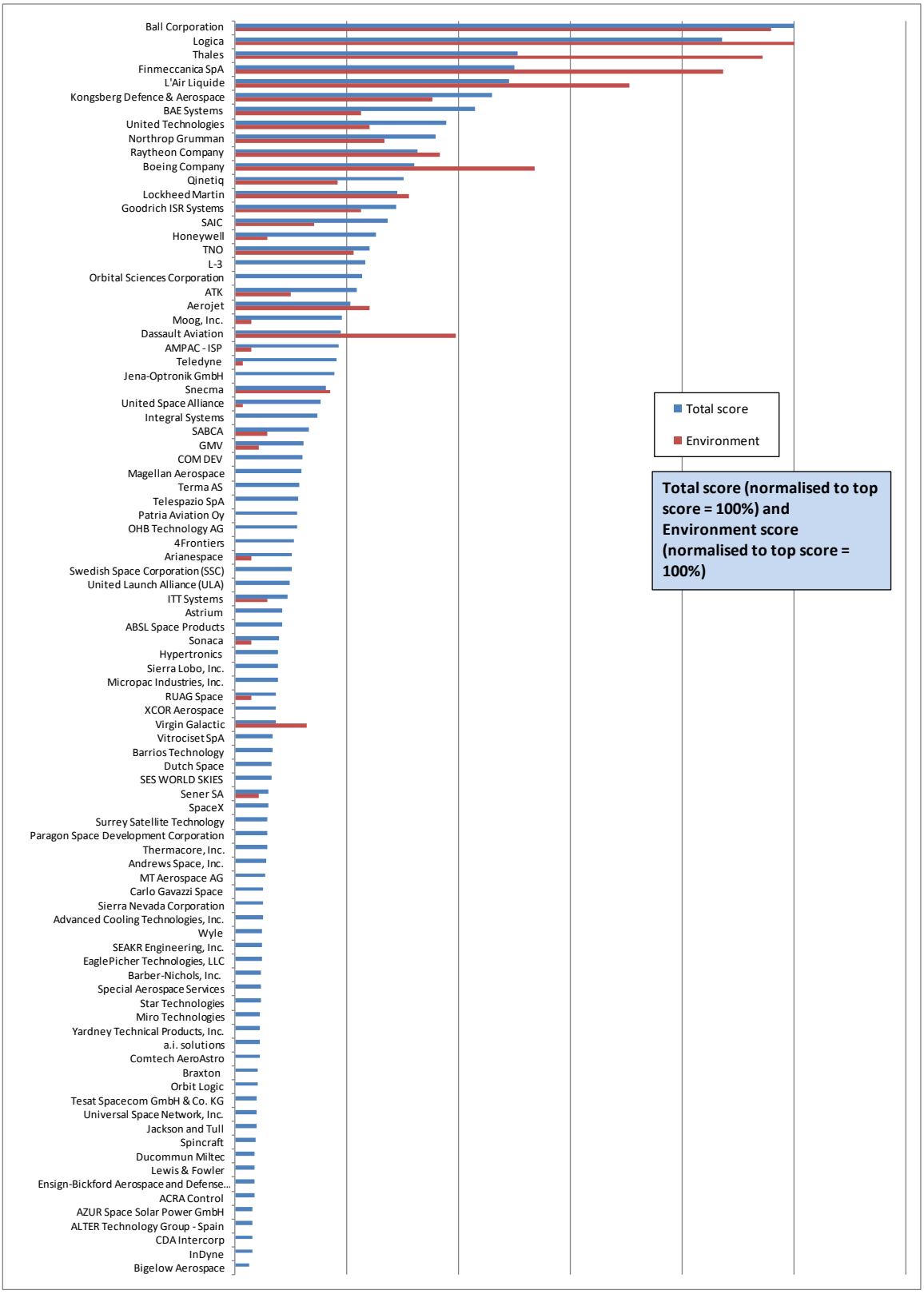

Figure 12: Total score and Environment score

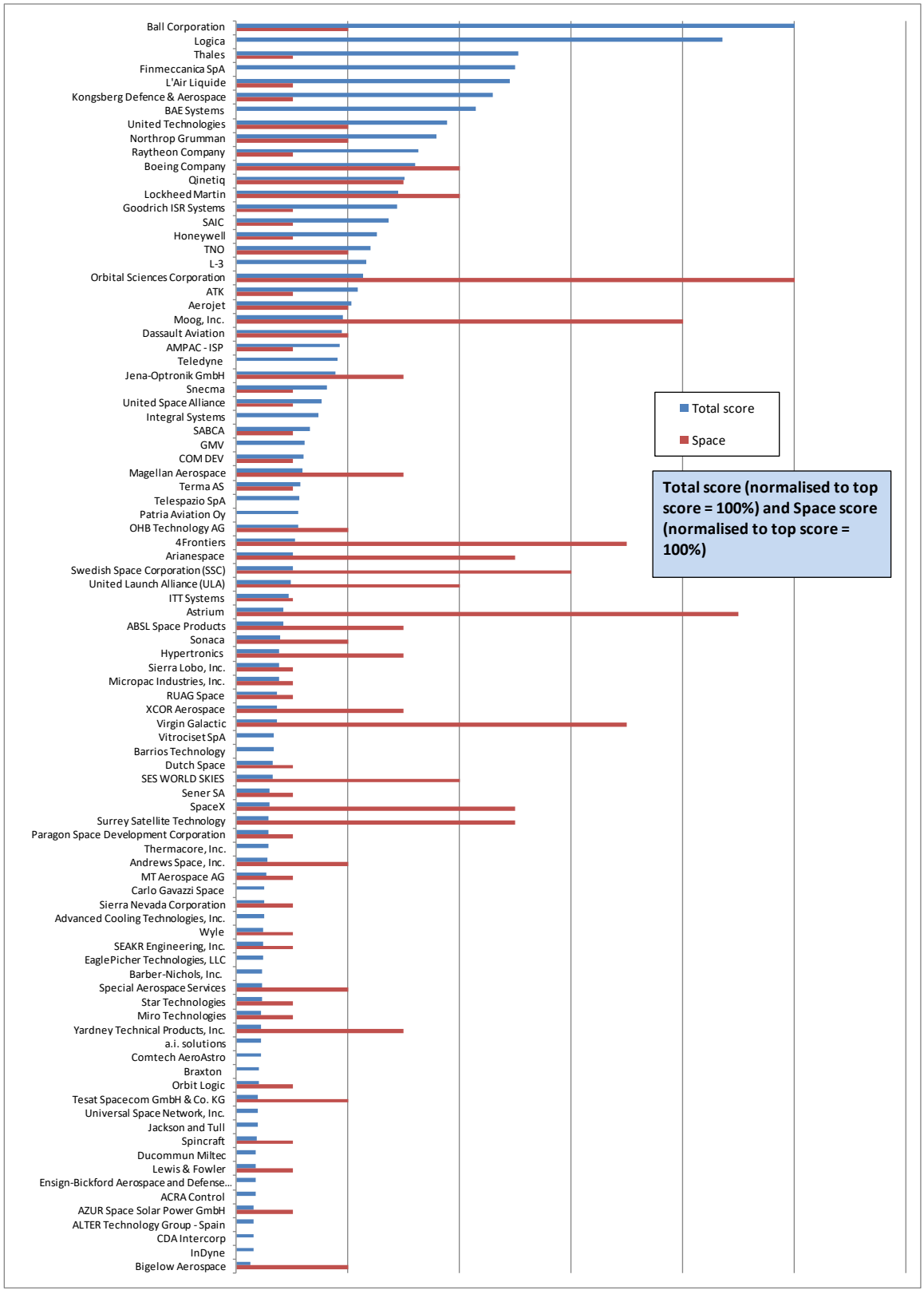

Figure 13: Total score and Space score

5.2 Discussion of results and findings

5.2.1 GRI bias

Studies such as Jones and Alabaster (1999) have shown the mode of individual scores to be the most appropriate statistical analysis of such results; we find two companies, Ball Aerospace and Logica have a mode of 4; the rest zero. We note with interest the only two companies to systematically use GRI guidelines in their reporting (ie base their reports on GRI guidelines, rather than indexing existing report to GRI). This mode analysis clearly shows companies who use GRI guidelines have an advantage in a GRI benchmarking, and we mention this here as another cautionary note when looking at the overall rankings. Perhaps using a different methodology, Ball Aerospace and Logica would not have ranked #1 and #2 respectively, although we can be sure they would rank highly by most metrics given the depth of their reporting. Furthermore, Dutch company TNO scored the highest of the non-listed companies, perhaps also due to its use of GRI (although more limited than Ball and Logica).

5.2.2 Discussion of the space results

We look more closely at the companies performing well in the space category, to work further on the analysis of these companies. Clearly space CSR is not subject to the same drivers as terrestrial CSR. We expect, today, a large listed company to score well in the environmental category, since such reporting is becoming the norm. But in space, our findings show how a small private rocket firm may well outperform a world leader when it comes to space operations CSR.

To shed some light on this, we will examine the “space” category results in more detail. First, we look at the top scorers in the space category, in Table 9 below.

Table 9: Top scorers in the space category

Space Rank	Company	Listed	Approx 2009 revenues/m	Country	Total score
1	Orbital Sciences Corporation	NYSE	$1,100	US	95
2	Astrium		$6,720	France	35
3	Moog, Inc.	NYSE	$1,800	NY, US	80
4=	4Frontiers		$1	FL, US	44
4=	Virgin Galactic		na	US	30
6	Swedish Space Corporation		$126	Sweden	42
7=	Arianespace		$1,400	France	42
7=	SpaceX		na	CA, US	25
7=	Surrey Satellite Technology		na	UK	24
10=	Boeing Company	NYSE	$68,300	IL, US	134
10=	Lockheed Martin	NYSE	$45,000	MD, US	121
10=	United Launch Alliance		na	CO, US	41
10=	SES World Skies		na	NJ, US	27

What makes these 13 companies different? Revenues vary from practically zero to $45 billion; the companies are located from Sweden to Illinois and only four of them are listed (all four on the New York Stock Exchange). They do not seem to have much in common at first glance... other than the clues in their company names: space, orbit, launch, galactic, satellite, frontiers. Indeed, of this list, 10 of the 13 are "pure" space companies working *only* in space activities: Orbital Sciences, Astrium, SSC, Arianespace, Surrey Satellite Technology, SES World Skies, SpaceX and ULA directly place people or payloads in orbit and work only in space travel; 4Frontiers plans

colonising Mars; Virgin Galactic plans to boost people into space. Of this list, only Moog, Boeing Company, Lockheed Martin have business lines outside space. This itself may answer our question "what makes the top scoring companies in the space category different?": they are predominantly space companies rather than companies with space interests.

With this in mind, we consider a variety of reasons for these interesting outcomes and seemingly "independence" of the space category.

1. Because space environmentalism is a relatively new area, the pioneers will be those individuals rather than corporate culture, and those individuals deeply immersed in space culture. A pure "space" company CEO is really inside it, and is likely a personality in the business, and a large part of a small community. While that community may not place too much emphasis on, say, corporate governance or environmentalism it does have a vested interest in responsible behaviour in space. A multi-conglomerate, on the other hand, has a CEO and chairman at greater distance from the space activity.

2. Because the law in space environmentalism and responsibility is so unclear... we cannot expect those traditionally "good" companies to necessarily have any leadership here. While legally they MUST develop a good sense of corporate governance/environmental behaviour, as by stock exchange guidelines and best practice such as GRI, there are no existing guidelines for CSR in space, no stakeholder pressure, no reason, at present, for these activities or responsibilities to be acknowledged or reported.

3. Stakeholder analysis – and perhaps this is just saying these same thing as points 1 & 2 in the more formal language of our CSR theory. For listed companies, stakeholders are shareholders; government (as main customer, policymaker and regulator), customers, labour unions. For our pure space companies, stakeholders are more likely customers (and in the virtual monopsony of space, there is practically only one customer per state); space community; media; and government (as customer, regulator and policymaker). Shareholder and non-governmental customer pressure today includes all aspect of "accepted" CSR such as economic, social and environment; while space companies, largely unlisted, do not face this traditional CSR pressure.

4. Companies which are involved in the human side of space exploration focus more on the CSR aspects in space. Overall league-table leader Ball Corporation, for example, is a leading provider of space instruments, such as the Hubble Space Telescope. But instruments don't kill people. Rockets and failed oxygen systems do.

5. There is also a possibility our "space supplement" is flawed, and that indeed our overall benchmarking methodology is flawed. The space supplement is a very subjective test. Following our rules, for example, Ball only scored "2" in the space indicator for detailing spacecraft in active service, providing useful information on the topic in its reports but not going into the same kind of depth we saw in other company's websites. But Ball's excellent reporting may have harmed its score here – for companies which had NO reporting, we would perhaps look a little deeper into their websites to find the information. If we had looked as deeply into Ball's website, rather than relying only on

the reports, the company would likely have scored higher. As such, we might expect the space scores to be higher for the companies with no formal report; the best reporters tend to only put terrestrial or information for their stakeholders in their reports, as is reporting best practice. The discussion addresses this and makes suggestions for future study/structure of the space.

5.2.3 Falling into our own trap

A limitation of this study was time; barely six months to complete. As a result of this, the main benchmarking study was concluded in parallel with the critical study of the literature. In hindsight, we would have made stronger emphasis on "power" and "social" side of space activities in our benchmarking indicators – in fact, we fell into the very trap we outline in Chapter 3 – there is more to CSR, sustainable development than "eco". We fell into this trap with a full knowledge of its presence, which is interesting in itself. Why, despite nearly two years' teaching from leading critical SD thinkers such as Welford and Springett, did we begin the benchmarking investigation looking at environmental issues? Inexperience in critical research is one reason. But also, in hindsight, the desire to have easily measurable indicators and categories which could be defined, scored, ticked – environment is a very concrete area to "yes or no", while "issues of power in policy making" is more of a gray area and harder to score.

We should be aware of this in our future work.

5.3 Cross-section analysis

From this ranking table, we can identify three interesting groups of companies to consider. The first is the companies which rank highly in all categories but perform

poorly in the space category. The second is companies which rank reasonably well in all categories, and perform very well in space category. The third is companies which rank poorly in all categories, but perform reasonably well in the space category.

With this criteria, we select six to discuss in more detail:

Table 10: Six companies selected for discussion

Company	Merit for discussion ("low" and "high" purely subjective)
Ball Aerospace	Highest overall score, low score in space
BAE Systems	High overall score, low space score.
Astrium	Low score overall but in top 10% of space companies
Virgin Galactic	As Astrium – also, high profile company
Orbital Sciences	Top ranking space company, also highest overall ranking of top 10% scoring space companies
SpaceX	Low overall score but in top 10% of space companies – one of the leading companies in developing commercial human spaceflight

5.3.1 Ball Corporation

Ball Corporation is a leading supplier of space instruments. Its record speaks for itself: the company, for example, built all of the instruments on the Hubble Space Telescope (Ball Aerospace, na) and it was the prime contractor for Deep Impact, NASA's eighth discovery mission, which collided a spacecraft with an asteroid 83 million miles from Earth.

While a leading provider of instruments, Ball's products do not have a direct "human" dimension. It makes instruments – but instruments do not kill people.

Ball has an excellent adherence to GRI guidelines; rather than indexing its CSR report with GRI indicators as some companies do, it actually reworks its reporting into the GRI G3 structure. In some ways, this may limit its "non-GRI" reporting and implies an acceptance of GRI as "good" CSR, possibly accounting for its lower score in the space category. If, for example, the "space supplement" was a necessary part of GRI reporting, we would expect Ball to achieve a higher score than it did.

5.3.2 BAE Systems

What first impressed us most about BAE Systems was its ethical code of conduct. It is of high standard, with in-depth employee guidelines, Q&A and many hypothetical situations with ethical quizzes.

But the company does not perform well in our space category. As with Ball, it supports our suppositions that non-pure space, companies with leaders far removed from the space industry will not pay as much attention to reporting space CSR activities.

As a defence contractor, BAE is an interesting example in terms of CSR. Some writers have called CSR reporting for weapons-makers ridiculous – Doane writes of BAE's early CSR reporting activities that they are "absurd"; (Doane, 2004, p. 82). But while we can find a certain ironic humour in the idea of a defence manufacturer applying "health and safety" ideas to its weapons, we can say that at least BAE was, at least addressing its own ethics, an important part of the CSR process. What may have appeared "absurd" at the outset in fact was the start of a powerful change within BAE, as see today in its reporting transparency and very real behavioural change. Our study has observed a similar

development in other major defence contractors (and with hypothetical ethical situations *ad nauseam).* While we see Doane's point, we also see CSR as the alcohol swab before the lethal injection - we shouldn't criticise the doctor for applying the swab; and if we opposed the death penalty, to extend the analogy, we would find the medical profession a far more useful ally than an enemy.

In terms of this study, we believe BAE Systems suffers a low score for the same reason as Ball Corporation. Its CSR reporting is influenced by global best practice, and space is simply not on the CSR reporting radar.

5.3.3 Astrium

Astrium is the largest pure space company; its public information regarding its space activities is wide and comprehensive. We see the main factor for its lower overall score is that it is part of a much bigger group, EADS, which has significant CSR reporting. Therefore many of the aspects in the GRI indicators, such as economic or social governance, are left to the parent CSR report, which we did not benchmark.

5.3.4 Virgin Galactic

We might expect Virgin Galactic to perform well in space category while not so strong in other categories – it supports our idea that space community members perform better in this regard, and is indeed perhaps one of the most high profile members of the space community. As Billings (2006) writes it is "by far the most publicised with its celebrity

head (Sir Richard Branson), designer logo (Philippe Starck), big-name spacecraft developer (Burt Rutan) and ultra-rich backer (Microsoft co-founder Paul Allen).

Of all the companies reviewed, we find Virgin's attempts at CSR the closest to what Banerjee terms as "ugly" (Banerjee, 2007). Our biggest criticism would be its appropriation of "space travel" as its expertise, including a discussion of how it is making environmentally-friendly alternatives to traditional rockets. This is greenwash of the worst kind – it is deceitful to compare the environmental qualities of its suborbital spacecraft" with orbital spacecraft.

However, looking from our stakeholder lens, we see Virgin Galactic may be balancing "media" as a larger stakeholder than other space firms. Its "environment" content may be a reaction to what it is asked for. Guardian writer X is often attacking Virgin, harping on in editorials about how Virgin would not provide CO2 emissions (as if this was the most relevant aspect of a new space operation) – Virgin's focus on this may represent this stakeholder pressure.

We also find consumer and labour issues lacking in Virgin's website. Its president, Will Whitehorn, has applauded "informed consent" (de Selding, 2010) protecting space tourism operators from lawsuits in the events of accidents. And FAA and NASA both require quite strict "inform" (Aeronautics and Space, 2006) as part of informed consent (see Appendix C).

But we note the early users of space tourism may not be the types to worry about risk[14], and that, in any case, we are surrounded by warnings regarding our own mortality. The sauna at the Fitness First, Harbour City, Hong Kong carries a warning that use of the room may cause death, and, if it should, Fitness First is in no way liable. Certainly even the most comprehensive, fattest document outlining certain death is unlikely to stop the early space tourists; and companies probably cannot do much about this yet. But it will become an issue. And from a CSR perspective, we see the most silent stakeholder group being workers, crew, labour. Safety of passengers will of course be a priority for companies such as Virgin Galactic. But labour issues should be brought to the fore if the industry is to develop in an equitable manner. Yes, airlines are said to be the safest form of transport; yet in the US, scheduled air transportation is one of the more dangerous occupations, certainly more dangerous than working railways or even mining (Bureau of Labor Statistics, 2009).

Finally, we note Virgin Galactic has counted on the state of New Mexico to build the spaceport from which it will operate (Billings, 2006) – from our critical CSR perspective, we would like to see more comment on such activities and its policy position and activities.

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[14] An amusing comment to de Selding's (2010) story is posted by space.com user vaxheadroom:
"Please check all boxes below to signify that you both understand and agree with them:
[ ] 1) I might die
[ ] 2) Even if I die, this will be totally awesome!
Signed: _____"

5.3.5 Orbital Sciences and SpaceX

> *Corporate responsibility should be about more than going beyond compliance. It must also include efforts to raise compliance standards. In fact, the most critical dimension of corporate responsibility may well be a company's impact on public policy. (Vogel, 2005, p. 171)*

As a result of recent US Senate (US Senate, 2010) hearings[15] into commercialisation of space, at which both Orbital Sciences and SpaceX testified, we have a rich source of information to discuss these companies' results in the wider context of power and policy influence.

The hearings homepage has a wealth of information for researcher interested in the play between business, government, regulators and other stakeholders such as former astronauts.

Both Orbital and SpaceX have strong ambitions in playing a major role in the new commercial space. At the hearings, Frank L. Culbertson Jr., Senior Vice President and Deputy General Manager, Advanced Programs Group, Orbital Sciences Corporation affirms his company's commitment to the business, saying that the key to a Moon, or Mars space station or base is a reliable supply line. "We at Orbital intend to be a key element in that supply line" (Culbertson, 2010).

[15] The website of the hearings is at http://tinyurl.com/spaceCSR1

The hearings came in the wake of US President Barack Obama's proposed sweeping changes to NASA and the US space business – commercial firms would supply the ISS, while NASA would drop its plans to build a base on the moon and head directly to Mars.

This has huge consequences for the space tourism industry, since low-cost human spaceflight – to orbit, not the 'lob' of high altitude low gravity experiences – would become commercial reality.

This collection of talking points from very legitimate stakeholders is fascinating reading, spanning spacelust, caution and even cold-war rhetoric about a Russian threat. The hearings offer good insight to the power and place the two company's benchmarking results in a good context to understand the business as a whole.

For SpaceX, President Gwynne Shotwell opens her arguments for the life of the ISS in economic terms: The US has invested US$27 billion in the ISS (without factoring in any space shuttle related costs) – NASA needs additional funding to extend its life. (Shotwell, 2010)

Shotwell says SpaceX cargo delivery systems can "easily" be modified to fly crew, with certain safety augmentations. If awarded the contract, it would be ready to fly astronauts to the ISS within three years of award date. (Shotwell, 2010)

The third part of Shotwell's remarks concern American security. "The following facts will come as a disturbing surprise to most Americans. From 2010 to 2017, or longer, the US will have no human spaceflight capability unless commercial services are developed; Russia will wield a monopoly with respect to manned carriage to the ISS. So while the

US has toiled to build the ISS – risking lives... we will not be able to access the ISS without paying Russia dearly." (Shotwell, 2010)

Shotwell returns to economic arguments. "It is not apparent what price Russia may demand for rides to the American-built portion of the ISS. Despite being relatively new players in the free market economy, [the Russians] are proving to be quite excellent capitalists." (Shotwell, 2010)

Another voice at the hearings, former NASA Comptroller Malcolm Peterson addressed the issue of the Russians. He noted the argument of some commentators who worry the Russians would "hold us hostage" and raise the price for Soyuz launch services, thus making the concept of a US-sourced spacecraft attractive. But Peterson says the argument, particularly the "balance of payments" argument, is disingenuous. "Sending US funds abroad to buy foreign goods is common - the amounts [for launching] are relatively trivial in that context. Those who obviously lack trust in the Russian entities conveniently ignore the interdependent nature of the US-Russian relationship..." (Peterson, 2010)

For Orbital, Culbertson first acknowledges the presence of Bryan O'Connor as the "Agency conscience" (Culbertson, 2010) on all matters regarding mission safety, and interesting choice of words. Culbertson is confident of the commercial sector's ability to meet teh challenges of putting humans into space. "NASA's proposed funding of about US$6bn together with the addition of appropriate private capital should be sufficient to enable at least one and probably two US commercial-provided crew systems to be demonstrated by the year 2015." He is confident NASA can work with commercial

entities to establish the proper safety and certification measures, and makes an offer: “Once such a service is developed, tested and certified, I would be happy to volunteer to strap in once again for a mission to the International Space Station. If I am not willing to join the first mission of an Orbital developed spacecraft that I share responsibility for, then no-one should be on that flight.” Culbertson says he does not envisage a commercially-provided crew-service being developed and operated fully by the industry with a “hands-off” approach from NASA. “Nor can such programmes be successful with full government oversight,” he says (Culbertson, 2010).

What is immediately apparent from both Culbertson and Shotwell’s comments is the eagerness of the commercial sector to take on the challenge of providing human spaceflight capability. On the surface we can see the “inducement, encouragement and persuasion” of Lukes’ conceptual map of power (Figure 14) and Lukes (1974), right at play here.

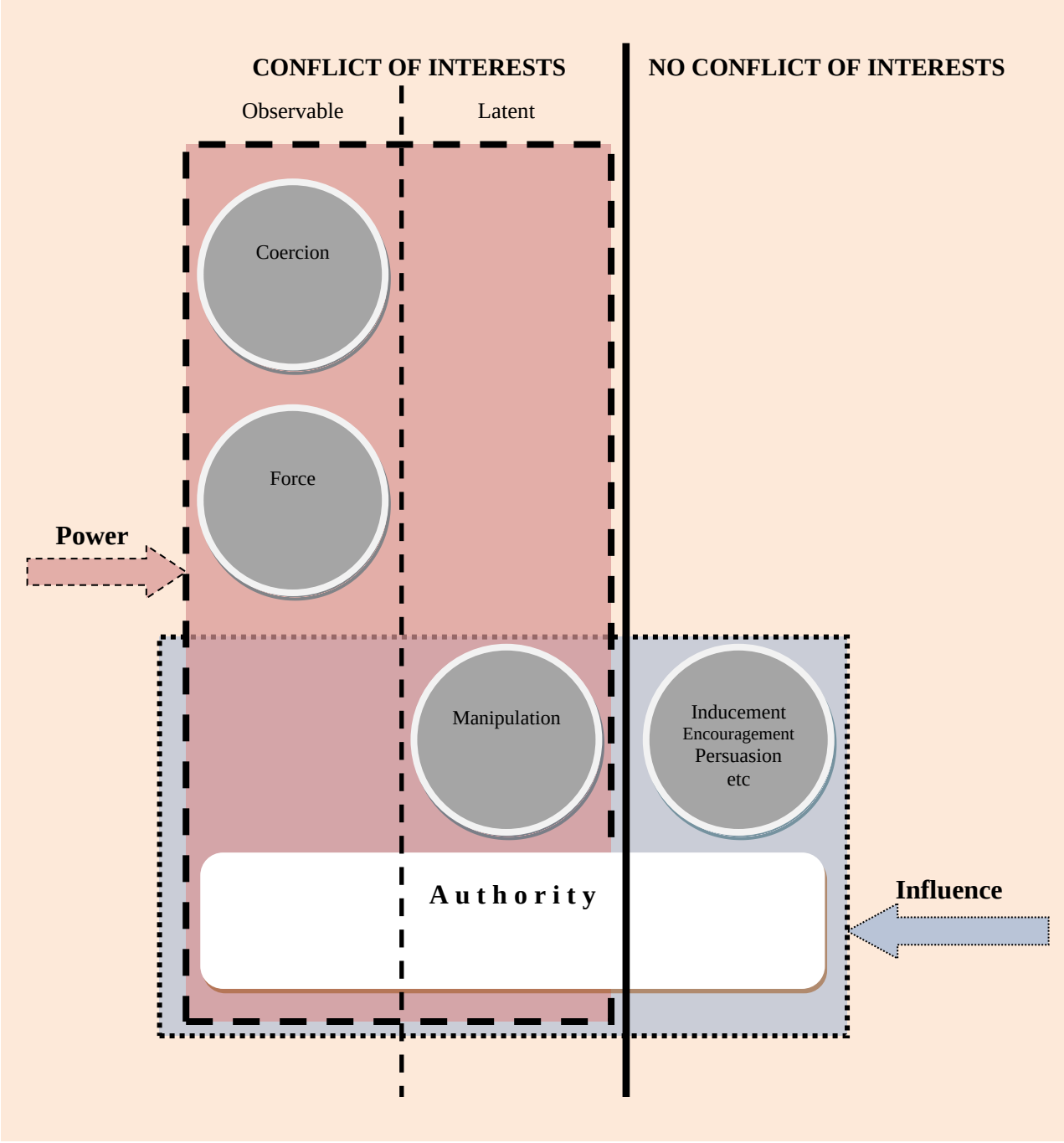

Figure 14: Lukes' conceptual map of power

From Lukes, we see Shotwell using the "third dimension" of power: rather than directly influencing Senate, her cold-war rhetoric ("Russians" "hostage" "wielding power" "US toil" "what may surprise Americans") could be viewed as seeking to create a desire in the American people to want to influence government to support private space development, the "supreme exercise of power" through shaping wants (Lukes, 1974, p. 23). If we see Shotwell's remarks as manipulative, rather than just persuasive, this would shift her influence and power across the tracks to the "latent conflict of interest" district of Lukes' conceptual power map.

But where is the conflict of interest? In fact, we would see the only latent "conflict of interest" is that commercial space is simply not ready to achieve human spaceflight safely, yet wants desperately to be given the chance to try. Shotwell makes the point that the SpaceX cargo ships can be modified within three years, detailing the safety modifications required – but she fails to mention the impact of g-forces on human crew, an effect cannot be designed out of a cargo ship by mere safety modifications, and which must be addressed. After all, as Peterson said at the same hearings, we are never as smart at safety as we think we are; while Bryan D. O'Connor, Chief, Safety and Mission Assurance, NASA, told Senate: "We still see new safety issues on the Space Shuttle after 130 flights." (US Senate, 2010)

Culbertson's comments that he would ride the ship himself are perhaps designed to instil confidence but they do not. We would be appalled if he *wouldn't* fly in his own product – but the fact that he offers doesn't make it safe. Again, perhaps such comments inch "persuasion" towards the "manipulation" side of the power map.

5.4 Chapter conclusion and key findings

We have investigated the state of CSR in space tourism and the wider space industry, and taken a closer look at six companies to examine the issue further. We now present our conclusions for the investigation, with a summary of our findings:

We can summarise our key findings as follows:

- Our benchmarking shows there is no traditional correlation between CSR reporting of space activities and other aspects such as environment or social dimensions.
- Pure space companies perform better in space CSR reporting than companies for which space is just one business line
- Size, location and ownerships status appears to have little influence on space CSR reporting – small space tourism companies outperform $45 billion aerospace companies
- Companies performing well in traditional CSR reporting do not necessarily perform well in the new area of space CSR reporting
- Under a GRI benchmarking in the space sector, listed companies perform better overall, and in all traditional GRI categories, than non-listed companies
- There is a conflict of interest between the desire of companies to open revenue streams to Low Earth Orbit and the desire of companies to maintain safety as the highest priority in space travel.

CHAPTER 6 CONCLUSIONS

We began this research project with the broad belief that space was on the verge of becoming the domain of corporations; that companies had little notion of their CSR when it came to space; that companies should begin to address issues such as “space debris” before the pliable social structures of a new space society hardened into inflexible institutions.

What we found was at odds with our original impression. While lacking the formal CSR reporting structure of today’s CSR leaders, space companies large and small did address some issues which impacted the space community.

We find most companies could do better in their space CSR reporting, particularly in describing their environmental impacts in space. From our cross-section analysis of “pure space” we saw greenwash from the most public-facing company yet from other firms, better transparency in terms of policy disclosure, perhaps better than we have seen from aerospace conglomerates.

6.1 Return to CSR theory

Before we end this investigation, we feel it would be useful to return to our literature review and our CSR theories. Given what we have learned as result of the benchmarking and the subsequent cross-section analysis, what form of CSR theory best fits the space industry?

Using Garriga & Melé, we can uncover which of these classifications would be most useful, or appropriate for the space sector and space tourism in particular. In areas where

prescribed legislation or regulation is perhaps missing, the integrative and economic theories are not as appropriate. Table 11 summarises, in our view, the most pertinent areas to space industry.

Table 11: CSR theory classifications and application to space industry

Type of theory	Approach	Applicable to space/space tourism?
Instrumental theories - economic	Maximisation of shareholder value	N: private companies perform better in benchmarking; Processes yet to develop
	Strategies for competitive advantage	N- No competitive advantage from being seen as socially responsible – aside from "business ethics" and government contractor corruption
	Cause-related marketing	N- CSR no value in marketing products
Political theories - power	Corporate constitutionalism	Y- Social responsibilities arise from amount of social power
	Integrated social contract theory	Y – a social contract between the company and society should exist
	Corporate (or business) citizenship	Y – the firm has an involvement in the community (wider, and local)
Integrative theories	Issues management	Y- response to political issues which may impact upon it
	Public responsibility	N- policy not taken as reference for social performance (as no policy exists)
	Stakeholder management	N- balances interests of stakeholders of the firm
	Corporate social	N – doesn't search for social legitimacy

	performance	
Ethical theories	Stakeholder normative theory	Y- duty to stakeholders
	Universal rights	Y-labour rights, respect for the environment?
	Sustainable development	Y- Considers present and future human generations
	The common good	Y- oriented towards common good

(Garriga & Melé, 2004) and author opinion (third column)

As a result of this analysis, we see power and ethical theories are the most appropriate to describe the space industry.

We conclude that stakeholders exert significant pressure on a company's CSR activity, and that, in pure space companies, the space community is the dominant stakeholder. This has significant implications for mergers and acquisitions, where space CSR may be diluted as companies are purchased and brought into those firms with different stakeholder priorities.

Through the activities of our investigation: the literature review; CSR reporting benchmarking and industry cross-section analysis, we find that corporate power and influence issues, ethics and safety will have a greater relevance to CSR as applied to space activities than any specific environmental problem.

On safety, we are not qualified to make safety judgements on the private companies operating in this area. But we note in particular the conflict of interest associated with companies' desires to get active in the business.

During the course of this investigation, we were fortunate enough to have a brief informal interview with an astronaut, NASA's Commander Christopher Cassidy, who flew Space Shuttle mission STS127 and spent several weeks aboard the ISS. As an off-the-cuff discussion, Cassidy's comments to us do not form part of the formal investigation; we use his remarks here to put the finishing touches.

Because we must draw a distinction between those adventurous souls such as early space tourism customers, and those who take risks as part of their job. A space tourist can choose to go or not to go; but astronauts such as Cassidy may be placed in the difficult position of choosing their career or their safety, if higher powers do not concern themselves unabashedly with safety. Cassidy would prefer to go "back to the Moon", rather than undertake a Mars mission – as he said:

> *"You don't take a ship out of the shipyard and sail right around the world. You sail with it in your local harbour and make sure everything works correctly, and I think that's a good reason for us to go to the Moon because you can get there in two days and if there are problems you can get home quickly. Once you go on a Mars mission, all of your equipment better work, or you're in a world of hurt." (Cassidy, 2010)*

But we believe that safety discussions, regarding individual missions, technology and the safety implications of wider space policy, should be held in the utmost transparency and with conflicts of interest addressed fully and in the open. We are impressed with the "fail operational, fail operational, fail safe" philosophy espoused by former astronaut Lieutenant General Thomas P. Stafford (Stafford, 2010) and believe, from a CSR

perspective, tomorrow's astronauts and potential space tourists deserve nothing less than "conflict of interest resolved, conflict of interest resolved; conflict of interest addressed" approach to corporate power in space.

The comments from SpaceX and Orbital are interesting; both companies are leaders in the commercial human spaceflight field; they are leaders in our space CSR results; they are vocal and open about their policy positions. We may find disagreement with their points of view; and criticise their rhetoric to some extent. But we note their involvement in the US political debate as a positive. Lukes (1974) cites Crenson and the case of US Steel in Gary, Indiana, which adopted silence as an approach to avoid tackling its local air pollution aspects. "US Steel for a long time effectively prevented the issue from even being raised, through its power reputation operating on anticipated reactions, then for a number of years thwarted attempts to raise the issue, and decisively influenced the content of the anti-pollution ordinance finally enacted. *Moreover, it did all this without acting or entering into the political arena."* (Lukes 1974, p42-43, emphasis added). From this power perspective we should find it promising the leading commercial human spaceflight operators are making their policy positions clear, in public and in the proper arena.

6.2 Recommendations

As a result of our research we make two recommendations; first, for corporations wishing to enhance their space CSR reporting, we offer our opinion in which areas might be most

appropriate to cover; and second, for the CSR industry to develop new reporting tools to help and encourage such reporting activities.

6.2.1 Recommendation: CSR Space Reporting

As a result of our benchmarking process, we see room for improvement in companies space SCR reporting. We would encourage all firms to divulge more information, in their CSR report, annual report or "Space CSR" report. Our research reveals the areas we feel should be awarded the most attention:

- Spacecraft fleet; craft underway; decommissioned yet still in space
- Components/spacecraft on other moons/planets; design/specs or link to such information, including quarantine and production information; and operational status
- Outline of firm's commitment to space CSR, including social, environmental, labour, human rights, firm's local community, space community, political lobbying and corporate governance;
- Political – political views, regarding space development; corporate lobbying efforts, regarding space, and to whom those lobbying efforts are directed; results of political activity. What kind of tax relief, concessions and other forms of corporate welfare do corporations obtain? What kinds of legal actions have corporations taken, against which actors, and what were the outcomes? What legal actions to corporations face and how do they respond? (These questions are based on questions posed by Banerjee (2007) in his outline for further CSR research).

- Safety: workplace accidents related to space activities; human health and safety; "craft" safety, and operational record.

6.2.2 Recommendation 2: CSR reporting guidelines

We would recommend further research and engagement with organisations such as GRI, and other CSR reporting organisations, to develop a "space supplement" for CSR reporting. The supplemental indicators we developed and used in our benchmarking may be a starting point but, we conclude, our space indicators focus too much on environment and social aspects of space; as a result of our investigation see power, ethics and safety as key foundation areas for CSR in space. We hope researchers would find this study and our initial work in developing a supplement useful in developing and testing a robust, credible set of guidelines.

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APPENDIX A: COMPANIES SELECTED FOR BENCHMARKING

Company	Listed	Approx 2009 revenues/US$m	Location
4Frontiers		$1	FL, US
a.i. solutions			MD, USA
ABSL Space Products			UK
ACRA Control			MD, US
Advanced Cooling Technologies, Inc.			PA, USA
Aerojet			CA, USA
ALTER Technology Group - Spain			Spain
AMPAC - ISP	NASDAQ: APFC	$64	NV, US
Andrews Space, Inc.		$8	WA, US
Arianespace		$1,400	France
Astrium		$6,720	France
ATK	NYSE: ATK	$4,600	MN, UIS
AZUR Space Solar Power GmbH			Germany
BAE Systems	LON.BA	$36,200	UK
Ball Corporation	NYSE: BLL	$7,300	CO, US
Barber-Nichols, Inc.			CO, US
Barrios Technology			TX, US
Bigelow Aerospace			NV, US
Boeing Company	NYSE: BA	$68,300	IL, US
Braxton			CO, US
Carlo Gavazzi Space			Italy
CDA Intercorp			FL, US
COM DEV	TSX: CDV	$230	ON, Canada
Comtech AeroAstro			VA, US
Dassault Aviation		$4,760	France
Ducommun Miltec			AL, US
Dutch Space			Netherlands
EaglePicher Technologies, LLC			MI, US
Ensign-Bickford Aerospace and Defense Company			CT, US
Finmeccanica SpA	Italy	$39,620	Italy
GMV			Spain
Goodrich ISR Systems	NYSE: GR	$6,700	NC, US
Honeywell	NYSE: HON	$39,900	NJ, US
Hypertronics			MA, US
InDyne		$250	VA, US
Integral Systems	NASDAQ: ISYS	$159	MD, US
ITT Systems	(parent listed)	$11,000	CO, US
Jackson and Tull			NE, US
Jena-Optronik GmbH	FRA:NKFURT JEN	$658	Germany

Kongsberg Defence & Aerospace	Oslo KOG	$1,800	Norway
L-3	NYSE: LLL	$15,600	NY, US
L'Air Liquide	Paris Euronext	$16,800	France
Lewis & Fowler			CO, US
Lockheed Martin	NYSE: LMT	$45,000	MD, US
Logica	LON,. Euronext	$3,600	UK
Magellan Aerospace	TSX: MAL	$686	Canada
Micropac Industries, Inc.	OBB	$17	TX, US
Miro Technologies			CA, US
Moog, Inc.	NYSE: MOGA	$1,800	NY, US
MT Aerospace AG		$168	Germany
Northrop Grumman	NYSE: NOC	$33,700	CA, US
OHB Technology AG	Frankfurt	$402	Germany
Orbit Logic			MD, US
Orbital Sciences Corporation	NYSE: ORB	$1,100	US
Paragon Space Development Corporation			AZ, US
Patria Aviation Oy		$539	Finalnd
Qinetiq	LSE: QQ	$2,584	UK
Raytheon Company	NYSE: RTN	$24,900	MA, US
RUAG Space			Switzerland
SABCA	Brussels EuroNext	$221	Belgium
SAIC	NYSE: SAI	$10,100	CA, US
SEAKR Engineering, Inc.			CO, US
Sener SA			Spain
SES WORLD SKIES			NJ, US
Sierra Lobo, Inc.			OH, US
Sierra Nevada Corporation			NV, US
Snecma		$5,579	france
Sonaca		$426	France
SpaceX			CA, US
Special Aerospace Services			CO, US
Spincraft			MA, US
Star Technologies			VA, US
Surrey Satellite Technology			UK
Swedish Space Corporation (SSC)		$126	Sweden
Teledyne	NYSE: TDY	$1,765	CA, US
Telespazio SpA		$605	Italy
Terma AS		$182	Denmark
Tesat Spacecom GmbH & Co. KG		$309	Germany
Thales	NYSE Euronext Paris	$18,060	France
Thermacore, Inc.			PA, US
TNO		$806	Netherlands
United Launch Alliance (ULA)			CO, US
United Space Alliance			TX, US

United Technologies	(parent NYSE:UTC)	$12,580	CT, US
Universal Space Network, Inc.			CA, US
Virgin Galactic			US
Vitrociset SpA			Italy
Wyle		$800	CA, US
XCOR Aerospace			CA, US
Yardney Technical Products, Inc.			CT, US

APPENDIX B: GRI AND SUPPLEMENT INDICATORS USED IN BENCHMARKING

1. Strategy and Analysis	
1.1	Statement from the most senior decisionmaker of the organization (e.g., CEO, chair or equivalent senior position) about the relevance of sustainability to the organization and its strategy.
1.2	Description of key impacts, risks and opportunities.
2. Organizational Profile	
2.1	Name of the organization.
2.2	Primary brands, products and/or services.
2.3	Operational structure of the organization, including main divisions, operating companies, subsidiaries and joint ventures.
2.4	Location of organization's headquarters.
2.5	Number of countries where the organization operates, and names of countries either with major operations or that are specifically relevant to the sustainability issues covered in the report.
2.6	Nature of ownership and legal form.
2.7	Markets served (including geographic breakdown, sectors served and types of customers/beneficiaries).
2.8	Scale of the reporting organization, including: number of employees; net sales (for private sector organizations) or net revenues (for public sector organizations); total capitalization broken down in terms of debt and equity (for private sector organizations); and quantity of products or services provided.
2.9	Significant changes during the reporting period regarding size, structure, or ownership including: the location of, or changes in operations, including facility openings, closings, and expansions; and changes in the share capital structure and other capital formation, maintenance and alteration operations (for private sector organizations).
2.10	Awards received in the reporting period.
3. Report Parameters (only for standalone env/CR reports!)	
3.1	Reporting period (e.g., fiscal/calendar year) for information provided.
3.2	Date of most recent previous report (if any).

3.3	Reporting cycle (annual, biennial, etc.).
3.4	Contact point for questions regarding the report or its contents.
3.5	Process for defining report content, including: determining materiality; prioritizing topics within the report; and identifying stakeholders the organization expects to use the report.
3.6	Boundary of the report (e.g., countries, divisions, subsidiaries, leased facilities, joint ventures, suppliers). See GRI Boundary Protocol for further guidance.
3.7	State any specific limitations on the scope or boundary of the report.
3.8	Basis for reporting on joint ventures, subsidiaries, leased facilities, outsourced operations and other entities that can significantly affect comparability from period to period and/or between organizations.
3.9	Data measurement techniques and the bases of calculations, including assumptions and techniques underlying estimations applied to the compilation of the Indicators and other information in the report.
3.10	Explanation of the effect of any re-statements of information provided in earlier reports and the reasons for such re-statement (e.g., mergers/acquisitions, change of the base years/periods, nature of business, measurement methods).
3.11	Significant changes from previous reporting periods in the scope, boundary or measurement methods applied in the report.
GRI Content Index	
3.12	Table identifying the location of the Standard Disclosures in the report.
Assurance	
3.13	Policy and current practice with regarding to seeking external assurance for the report. If not included in the assurance report accompanying the sustainability report, explain the scope and basis of any external assurance provided. Also explain the relationship between the reporting organization and the assurance provider (s).
4. Governance, Commitments, and Engagement	
4.1	Governance structure of the organization, including committees under the highest governance body responsible for specific tasks, such as setting strategy or organizational oversight.

4.2	Indicate whether the Chair of the highest governance body is also an executive officer (and, if so, their function within the organization's management and the reasons for this arrangement).
4.3	For organizations that have a unitary board structure, state the number of members of the highest governance body that are independent and/or non-executive members.
4.4	Mechanisms for shareholders and employees to provide recommendations or direction to the highest governance body.
4.5	Linkage between compensation for members of the highest governance body, senior managers and executives (including departure arrangements), and the organization's performance (including social and environmental performance).
4.6	Processes in place for the highest governance body to ensure conflicts of interest are avoided.
4.7	Process for determining the qualifications and expertise of the members of the highest governance body for guiding the organization's strategy on economic, environmental, and social topics.
4.8	Internally developed statements of mission of values, codes of conduct and principles relevant to economic, environmental and social performance and the status of their implementation. Explain the degree to which these: are applied across the organization in different regions and department/units; and relate to internationally agreed standards.
4.9	Procedures of the highest governance body for overseeing the organization's identification and management of economic, environmental and social performance, including relevant risks and opportunities, and adherence or compliance with internationally agreed standards, codes of conduct and principles.
4.10	Processes for evaluating the highest governance body's own performance, particularly with respect to economic, environmental and social performance.
4.11	Explanation of whether and how the precautionary approach or principles is addressed by the organization. Article 15 of the Rio Principles introduced the precautionary approach. A response to 4.11 could address the organization's approach to risk management in operational planning or the development and introduction of new products.

4.12	Externally developed economic, environmental and social charters, principles or other intiatives to which the organization subscribes or endorses.
4.13	Memberships in associations (such as industry associations) and/or national/international advocacy organizations in which the organization: has positions in governance bodies, participates in projects or committees; provides substantive funding beyond routine membership dues; or views membership as strategic.
4.14	List of stakeholder groups engaged by the organization. Examples of stakeholder groups are: communities; civil society; customers; shareholders and providers of capital; suppliers; and employees, other workers and their trade unions.
4.15	Basis for indentification and selection of stakeholders with whom to engage.
4.16	Approaches to stakeholder engagement, including frequency of engagement by type and by stakeholder group.
4.17	Key topics and concerns that have been raised through stakeholder engagement, and how the organization has responded to those key topics and concerns, including through its reporting.
5. Economic	
EC1	Economic value generated and distributed, including revenues, operating costs, employee compensation, donations and other community investments, retained earnings, and payments to capital providers and governments. (Core)
EC2	Financial implications and other risks and opportunities for the organization's activities due to climate change. (Core)
EC3	Coverage of the organization's defined benefit plan obligations. (Core)
EC4	Significant financial assistance received from government. (Core)
Market Presence	
EC5	Range of ratios of standard entry level wage compared to local minimum wage at significant locations of operation. (Additional)
EC6	Policy, practices, and proportion of spending on locally-based suppliers at significant locations of operation. (Core)
EC7	Procedures for local hiring and proportion of senior management hired from the local community at significant locations of operation. (Core)
Indirect Economic Impacts	
EC8	Development and impact of infrastructure investments and services provided primarily for public benefit through commercial, in-kind, or pro bono engagement. (Core)
EC9	Understanding and describing significant indirect economic impacts, including the extent of impacts. (Additional)

6. Environmental	
Materials	
EN1	Materials used by weight or volume. (Core)
EN2	Percentage of materials used that are recycled input materials. (Core)
Energy	
EN3	Direct energy consumption by primary energy source. (Core)
EN4	Indirect energy consumption by primary source. (Core)
EN5	Energy saved due to conservation and efficiency improvements. (Additional)
EN6	Initiatives to provide energy-efficient or renewable energy based products and services, and reductions in energy requirements as a result of these initiatives. (Additional)
EN7	Initiatives to reduce indirect energy consumption and reductions achieved. (Additional)
Water	
EN8	Total water withdrawal by source. (Core)
EN9	Water sources significantly affected by withdrawal of water. (Additional)
EN10	Percentage and total volume of water recycled and reused. (Additional)
Biodiversity	
EN11	Location and size of land owned, leased, managed in, or adjacent to, protected areas and areas of high biodiversity value outside protected areas. (Core)
EN12	Description of significant impacts of activities, products, and services on biodiversity in protected areas and areas of high biodiversity value outside protected areas. (Core)
EN13	Habitats protected or restored. (Additional)
EN14	Strategies, current actions, and future plans for managing impacts on biodiversity. (Additional)
EN15	Number of IUCN Red List species and national conservation list species with habitats in areas affected by operations, by level of extinction risk. (Additional)
Emissions, Effluents, and Waste	
EN16	Total direct and indirect greenhouse gas emissions by weight. (Core)
EN17	Other relevant indirect greenhouse gas emissions by weight. (Core)
EN18	Initiatives to reduce greenhouse gas emissions and reductions achieved. (Additional)
EN19	Emissions of ozone-depleting substances by weight. (Core)
EN20	NOx, SOx, and other significant air emissions by type and weight. (Core)
EN21	Total water discharge by quality and destination. (Core)
EN22	Total weight of waste by type and disposal method. (Core)
EN23	Total number and volume of significant spills. (Core)
EN24	Weight of transported, imported, exported, or treated waste deemed hazardous under the terms of the Basel Convention Annex I, II, III, and VIII, and percentage of transported waste shipped internationally. (Additional)
EN25	Identity, size, protected status, and biodiversity value of water bodies and related habitats significantly affected by the reporting organization's discharges of water and runoff. (Additional)
Products and Services	
EN26	Initiatives to mitigate environmental impacts of products and services, and extent of impact mitigation. (Core)
EN27	Percentage of products sold and their packaging materials that are reclaimed by category. (Core)

Compliance	
EN28	Monetary value of significant fines and total number of non-monetary sanctions for non-compliance with environmental laws and regulations. (Core)
Transport	
EN29	Significant environmental impacts of transporting products and other goods and materials used for the organization's operations, and transporting members of the workforce. (Additional)
Overall	
EN30	Total environmental protection expenditures and investments by type. (Additional)
7. Social Performance: Labor Practices & Decent Work	
Employment	
LA1	Total workforce by employment type, employment contract, and region. (Core)
LA2	Total number and rate of employee turnover by age group, gender, and region. (Core)
LA3	Benefits provided to full-time employees that are not provided to temporary or part-time employees, by major operations. (Additional)
Labor/Management Relations	
LA4	Percentage of employees covered by collective bargaining agreements. (Core)
LA5	Minimum notice period (s) regarding significant operational changes, including whether it is specified in collective agreements. (Core)
Occupational Health and Safety	
LA6	Percentage of total workforce represented in formal joint management-worker health and safety committees that help monitor and advise on occupational health and safety programs. (Additional)
LA7	Rates of injury, occupational diseases, lost days, and absenteeism, and number of work-related fatalities by region. (Core)
LA8	Education, training, counseling, prevention, and risk-control programs in place to assist workforce members, their families, or community members regarding serious diseases. (Core)
LA9	Health and safety topics covered in formal agreements with trade unions. (Additional)
Training and Education	
LA10	Average hours of training per year per employee by employee category. (Core)
LA11	Programs for skills management and lifelong learning that support the continued employability of employees and assist them in managing career endings. (Additional)
LA12	Percentage of employees receiving regular performance and career development reviews. (Additional)
Diversity and Equal Opportunity	
LA13	Composition of governance bodies and breakdown of employees per category according to gender, age group, minority group membership, and other indicators of diversity. (Core)
LA14	Ratio of basic salary of men to women by employee category. (Core)
6. Social Performance: Human Rights	
Investment and Procurement Practices	

HR1	Percentage and total number of significant investment agreements that include human rights clauses or that have undergone human rights screening. (Core)
HR2	Percentage of significant suppliers and contractors that have undergone screening on human rights and actions taken. (Core)
HR3	Total hours of employee training on policies and procedures concerning aspects of human rights that are relevant to operations, including the percentage of employees trained. (Additional)
Non-Discrimination	
HR4	Total number of incidents of discrimination and actions taken. (Core)
Freedom of Association and Collective Bargaining	
HR5	Operations identified in which the right to exercise freedom of association and collective bargaining may be at significant risk, and actions taken to support these rights. (Core)
Child Labor	
HR6	Operations identified as having significant risk for incidents of child labor, and measures taken to contribute to the elimination of child labor. (Core)
Forced and Compulsory Labor	
HR7	Operations identified as having significant risk for incidents of forced or compulsory labor, and measures to contribute to the elimination of forced or compulsory labor. (Core)
Security Practices	
HR8	Percentage of security personnel trained in the organization's policies or procedures concerning aspects of human rights that are relevant to operations. (Additional)
Indigenous Rights	
HR9	Total number of incidents of violations involving rights of indigenous people and actions taken. (Additional)
8. Social Performance: Society	
Community	
SO1	Nature, scope, and effectiveness of any programs and practices that assess and manage the impacts of operations on communities, including entering, operating, and exiting. (Core)
Corruption	
SO2	Percentage and total number of business units analyzed for risks related to corruption. (Core)
SO3	Percentage of employees trained in organization's anti-corruption policies and procedures. (Core)
SO4	Actions taken in response to incidents of corruption. (Core)
Public Policy	
SO5	Public policy positions and participation in public policy development and lobbying. (Core)
SO6	Total value of financial and in-kind contributions to political parties, politicians, and related institutions by country. (Additional)
Anti-Competitive Behavior	
SO7	Total number of legal actions for anti-competitive behavior, anti-trust, and monopoly practices and their outcomes. (Additional)
Compliance	
SO8	Monetary value of significant fines and total number of non-monetary sanctions for non-compliance with laws and regulations. (Core)

9. Social Performance: Product Responsibility	
Customer Health and Safety	
PR1	Life cycle stages in which health and safety impacts of products and services are assessed for improvement, and percentage of significant products and services categories subject to such procedures. (Core)
PR2	Total number of incidents of non-compliance with regulations and voluntary codes concerning health and safety impacts of products and services during their life cycle, by type of outcomes. (Additional)
Products and Service Labeling	
PR3	Type of product and service information required by procedures, and percentage of significant products and services subject to such information requirements. (Core)
PR4	Total number of incidents of non-compliance with regulations and voluntary codes concerning product and service information and labeling, by type of outcomes. (Additional)
PR5	Practices related to customer satisfaction, including results of surveys measuring customer satisfaction. (Additional)
Marketing Communications	
PR6	Programs for adherence to laws, standards, and voluntary codes related to marketing communications, including advertising, promotion, and sponsorship. (Core)
PR7	Total number of incidents of non-compliance with regulations and voluntary codes concerning marketing communications, including advertising, promotion, and sponsorship by type of outcomes. (Additional)
Customer Privacy	
PR8	Total number of substantiated complaints regarding breaches of customer privacy and losses of customer data. (Additional)
Compliance	
PR9	Monetary value of significant fines for non-compliance with laws and regulations concerning the provision and use of products and services. (Core).
SUPP: Space Operations Supplement (non GRI)	
SP1	Number of spacecraft controlled by the reporting organisation, including how many presently underway
SP2	Number/details of launch vehicles, hardware in operation, underway now or in the past in space
Environmental	
SP3	Recognition of environmental and social issues in space, and the company's role in this sphere
SP4	Description of policies and programmes on the management of environmental impacts in space: space debris; plantary contamination
SP5	Description of environmental impacts of the reporting organisation’s major space-based infrastructure assets. Report the results of environmental impact assessments.
SP6	External Codes of conduct or international space agreements adhered to, eg COUPOUS, certifications
Social	
SP7	Crew safety issues and vehicle reliability

APPENDIX C: INFORMED CONSENT REGULATIONS

Regulations for notifying space flight participants of risk

Taken from (Aeronautics and Space, 2006)**, Code of Federal Regulations Title 14, 460.45:**

a**) Before receiving compensation or making an agreement to fly a space flight participant,** an operator must satisfy the requirements of this section. An operator must inform each space flight participant in writing about the risks of the launch and reentry, including the safety record of the launch or reentry vehicle type. An operator must present this information in a manner that can be readily understood by a space flight participant with no specialized education or training, and must disclose in writing—

(1) For each mission, each known hazard and risk that could result in a serious injury, death, disability, or total or partial loss of physical and mental function;

(2) That there are hazards that are not known; and

(3) That participation in space flight may result in death, serious injury, or total or partial loss of physical or mental function.

(b) An operator must inform each space flight participant that the United States Government has not certified the launch vehicle and any reentry vehicle as safe for carrying crew or space flight participants.

(c) An operator must inform each space flight participant of the safety record of all launch or reentry vehicles that have carried one or more persons on board, including both U.S. government and private sector vehicles. This information must include—

(1) The total number of people who have been on a suborbital or orbital space flight and the total number of people who have died or been seriously injured on these flights; and

(2) The total number of launches and reentries conducted with people on board and the number of catastrophic failures of those launches and reentries.

(d) An operator must describe the safety record of its vehicle to each space flight participant. The operator's safety record must cover launch and reentry accidents and human space flight incidents that occurred during and after vehicle verification performed in accordance with §460.17, and include—

(1) The number of vehicle flights;

(2) The number of accidents and human space flight incidents as defined by section 401.5; and

(3) Whether any corrective actions were taken to resolve these accidents and human space flight incidents.

(e) An operator must inform a space flight participant that he or she may request additional information regarding any accidents and human space flight incidents reported.

(f) Before flight, an operator must provide each space flight participant an opportunity to ask questions orally to acquire a better understanding of the hazards and risks of the mission, and each space flight participant must then provide consent in writing to participate in a launch or reentry. The consent must—

(1) Identify the specific launch vehicle the consent covers;

(2) State that the space flight participant understands the risk, and his or her presence on board the launch vehicle is voluntary; and

(3) Be signed and dated by the space flight participant