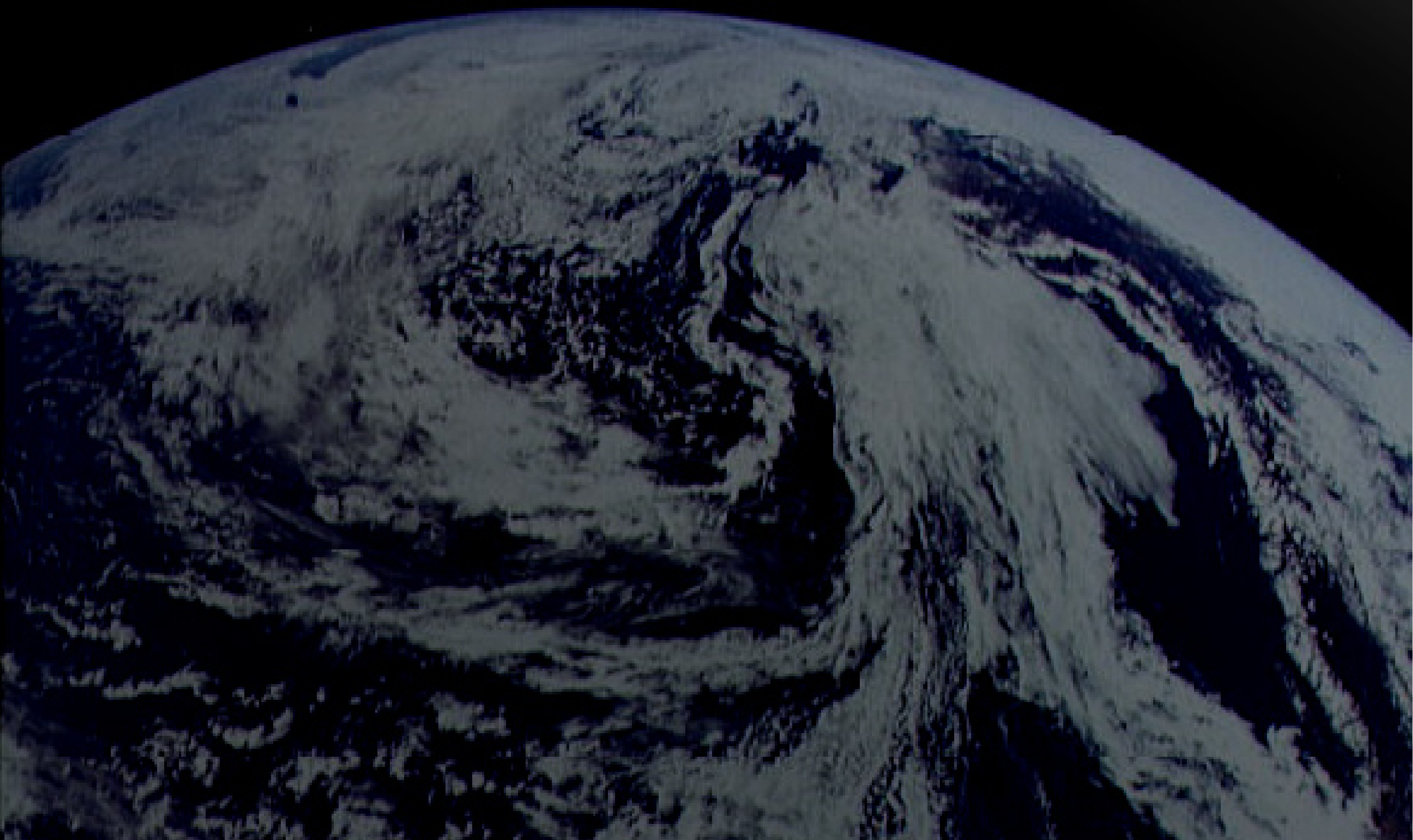
Going Where No Tourist Has Gone Before

The Future Demand for Space Tourism

The Future Choice Initiative



This research was conducted by the Australian Graduate School of Management's (AGSM) Centre for Corporate Change (CCC), the Centre for the Study of Choice (CenSoC) at The University of Technology, Sydney (UTS) and the School of Business at Latrobe University (Latrobe), as part of the Future Choice Initiative.

Cover photo: NASA

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Associated Press

Commander Yuri Usachev, left, welcomes L.A. multimillionaire Dennis Tito, center, and cosmonaut Talgat Musabayev aboard the International Space Station.

Tito Wants to Open Space Travel to All

Adventures: Executive who paid $20 million for trip says, 'Anybody can do it.'

Tito said space travel is exhilarating and emotional, and the view of Earth is awe-inspiring. He said he listened to opera as he gazed out the space station's portholes and shot 30 rolls of film.

somewhat understandable because bureaucracies don't like to change, and this clearly forced a change and it's going to have an impact."

Tito said he hoped the U.S. space agency might be persuaded now to bring private citizens into its program.

"I would like to ... NASA to include in ... passenger shuttl... one seat with ... who repre... pects o... pho...

Lottery, Page A2
VOLUME 265
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Boston Sunday

JUNE 20, 2004

Rocket plane strives to break space barrier

Privately financed ...d would be a first

By Beth Daley

...orrow morning, in the ... Mojave Desert, a bul... ...t plane will attempt ...bove the surface of ... to become the ...anned vehicle

Ansari X Prize — a $10 million award offered by a St. Louis foundation for the first private spacecraft to prove it can ferry people to space.

▸ Incentives grow for private-sector innovation. Ideas, D5.

If successful, the attempt could mark not just a landmark flight, but the start of a new type of space race: one among companies instead of countries.

"One person does it, and it shows it can be possible in the future," said Gregg Maryniak, chief operating offi-

cer of the X Prize, funded by a consortium of companies and individuals.

Conceived in 1996, the prize is designed to help shift the promises of space tourism and business from the hands of governments or the ultra-rich. The purse, which expires in January, has already sparked competing efforts by 26 teams from seven countries, which have spent an estimated $400 million trying to design and build a ship capable of meeting the prize's requirements: the ability to carry three people to space and back, then repeating the feat in two weeks.

LAUNCH, Page A10

The manned SpaceShipOne is scheduled for launching tomorrow.

Michael W. Melvill after landing SpaceShipOne yesterday.

Manned Private Craft Reaches Space in a Milestone for Flight

By JOHN SCHWARTZ

MOJAVE, Calif., June 21 — A veteran civilian test pilot on Monday became the first human to reach space in a privately developed program, guiding a tiny rocket ship ... climbed atop the spaceship, spread his arms and gave a primal holler: "Yeeeeeee-haaah!" ... Both craft were designed by Burt Rutan and his company, Scaled Composites ...

Travel 8

Fancy a trip to space?

Going Where No Tourist Has Gone Before: The Future Demand for Space Tourism

About the authors

Timothy Devinney is a Professor at the Australian Graduate School of Management (AGSM), and Director of the Centre for Corporate Change. Before joining the AGSM he held positions on the faculties of Vanderbilt University and UCLA and has been a visiting faculty member at numerous universities in Europe (London Business School, Copenhagen Business School and the Universities of Hamburg, Trier, Konstanz, Ulm and Frankfurt) and Asia (Hong Kong University of Science and Technology and City University, Hong Kong) and taught at many others (e.g., CEIBS–Shanghai, Helsinki University of Technology and Helsinki School of Economics). He has published six books (the most recent being *Managing the Global Corporation* (with J. de la Torré and Y. Doz, 2000) and the forthcoming *Knowledge Creation and Innovation Management* (with D. Midgley and C. Soo)) and more than sixty articles in leading journals

Timothy's degrees are: BSc (Magna Cum Laude – Psychology and Applied Mathematics), Carnegie Mellon University; MA, MBA, PhD (Economics), University of Chicago.

Geoffrey I. Crouch is Professor of Marketing and Head of the Department of Management and Marketing in the School of Business, La Trobe University, Australia. His area of expertise is tourism marketing with particular interest in tourist choice modelling, destination marketing and competitiveness, tourism psychology and consumer behaviour, and space tourism. Professor Crouch serves on a number of Editorial Review Boards of scholarly journals and is Co-Editor-in-Chief of the journal, *Tourism Analysis*. He has published numerous academic articles in leading journals including the *Journal of Travel Research*, *Tourism Management*, *Annals of Tourism Research*, and the *Journal of Business Research*. He is also a co-author of the book, *The Competitive Destination: A Sustainable Tourism Perspective.* He is a Fellow of the International Academy for the Study of Tourism.

Geoffrey's degrees are: BE (1st class Honours), M Eng Sc, MBA, PhD (Marketing), Monash University.

Jordan Louviere is Professor of Marketing and Co-Director of the Centre for the Study of Choice (CenSoC) at UTS in Sydney. Jordan's career includes stints at several US and Canadian universities (Florida State, Wyoming, Iowa, Utah, Alberta). He came to Sydney in 1994 as Foundation Chair of Marketing At Sydney Uni. Jordan's research focuses on understanding and modeling human judgement, decision-making and choice behaviours. He pioneered the use of large scale experiments to study consumer behaviour, and model consumer responses to new products and innovations. He has authored/coauthored over 150 refereed papers, book chapters and books in this area, and is a recognised world leader in this area. He has cofounded several companies, served as Head of R&D of tech startups, and been a consultant to numerous major companies and government agencies in North America, Europe and the Asia-Pacific. His current ARC & NHMRC funded projects include understanding & modeling patient, doctor and other stakeholder decisions in healthcare, developing ways to segment and model choices of farmers in rural Australia, developing theory and methods to model the choices of single individuals, understanding & modeling choices in response to complete & incomplete product information, developing ways to enhance visitation at major museums in Eastern Australia and understanding and modeling the value that consumers place on socially responsible products.

About the research team

Sandra A. Peter is a Doctoral candidate at CentER Graduate School, Tilburg University, The Netherlands and a Research assistant at the Centre for Corporate Change, Australian Graduate School of Management (AGSM). She is completing her doctoral dissertation and her current interests are innovation, social networks and cognition.

Sandra's degrees are: BSc (Honours – Economic Sciences), MA (Organization and Strategy) Tilburg University, The Netherlands

Steve Cook has been managing major IT implementations for 9 years. Previously a commercial photographer, Steve's experience covers the breadth of the media and IT industries and has seen him in management roles both in Australia and overseas. In 1999 Steve headed up production as 2IC of Spike Cyberworks in Japan, building multilingual teams to handle projects for the Toyota Motor Corporation, Daimler Chrysler, Issey Miyake, Nikko Salomon Smith Barney, Levis and advertising agency, I&S BBDO. Spike's Tokyo office was the most profitable regional office and operated as a dominant force in Japan in the disciplines of application development, online business strategy, integrated communications and campaign development.

Steve moved to France in 2001 where he liaised for American and Australian interests in establishing European IT based projects, before returning to Australia in 2003 to begin work with Academics from the AGSM and UTS to develop the world's first automated Information Acceleration and Choice Modeling software.

Michael McGee was Assistant Financial Controller of auction house Sotheby's and Commercial Manager for a multi-million dollar retail property development before entering the technology sphere. He was Business Affairs Director of internet developer Spike (a rapid-growth Asia Pacific player that was to list on the ASX), Managing Director of the Asia Pacific subsidiary of New York headquartered OVEN Digital, and General Manger of local tech/media firm Nethead.

Combining IT experience with an academic background in Economics and Econometrics, Michael began working in choice modelling research in 2002, becoming a Research Associate with the Australian Graduate School of Management, , and eventually forming Future and Simple with Steve Cook in 2003. Future and Simple manages major choice projects for Australian and international clients such as Westpac, Motorola, and a Space Tourism consortium.

Advisory Board Partners

Dr. Buzz Aldrin. Apollo 11 astronaut and first moon landing. Today Buzz Aldrin continues to take an active interest in space development, including space tourism through his initiatives with ShareSpace Foundation and Starcraft Boosters Inc.

Derek Webber. Director of Spaceport Associates. Derek has built a considerable reputation in the public space travel sector, following successes in the global commercial satellite communications sector. Recently, he managed the $1.8M ASCENT Study into space markets for NASA Marshall Space Flight Center, and was study director for the Futron/Zogby survey of demand for public space travel.

Paul Young. Director of the UK-based Starchaser Industries Limited, a privately held, high technology company that specialises in the development, operation and commercialisation of space related products and services. Starchaser Industries also has an established and highly successful Outreach Programme that engages with both the general public and education. Starchaser's educational activities complement the UK national curriculum and help inspire and motivate students at all levels to pursue careers in the fields of Science, Technology, Engineering, and Mathematics (STEM).

Dr. Peter Diamandis. Chairman of the X-Prize Foundation, a non-profit education organization promoting the formation of space-related prizes. He also serves as President and Chief Operating Officer of Angel Technologies Corporation. He co-founded the International Space University (ISU) based in Strasbourg, France, and currently serves as a Trustee. Peter received his undergraduate and graduate degrees in aerospace engineering from MIT and his M.D. from Harvard Medical School and is the recipient of numerous awards, including: MIT's Kresge Award, the 1986 Space Industrialization Fellowship Award, the 1988 Aviation Week and Space Technology laurel, the 1993 Space Frontier Foundation Pioneer Award, and the Russian 1995 K.E. Tsiolkovsky Award.

Eric Anderson, is President and CEO of Space Adventures. Before co-founding Space Adventures, he previously worked as a NASA researcher, as a Lead Engineer for a leading aerospace software firm, and has started several companies. Eric has sold over $50M worth of commercial human spaceflights, and is a leading expert on space tourism who appears regularly on CNN, FOX, NBC, and in other major media.

Patricia Grace-Smith. Associate Administrator for Commercial Space Transportation in the US Federal Aviation Administration.

Acknowledgments

We would like to thank our respective universities and Starchaser Industries for their financial support for this project as well as Pauline Olive, Fran Prior, Omer Konacki and Jennifer Laing for their administrative assistance on this project.

Tiny Tonga woos space tourists

rockets taking tourists into orbit at a cost of $US2 million ($A3.9 million) a head for week-long trips, beginning in 2005.

Yesterday it announced its first customer: Wally Funk, a

Travel's Final Frontier

Government Begins to Outline Rules on Space Tourism, With Trips as Soon as 2007

BLASTOFFS ON A BUDGET

Private ventures seeking to make routine access to space affordable see big potential in going small

By Joan C. Horvath

Executive Summary

Today is the dawning of a new age—an age where individuals with spare $20 million can partake of orbital space flight. Natural industry evolution implies that perhaps in the not too distant future, such an opportunity will be open to the average consumer. Although such space tourism will not necessarily be an alternative to a weekend at the beach, it will, for many people, be an alternative to other outdoor adventures.

The present study examined the demand for space tourism alternatives by using state of the art discrete choice modelling approaches to determine the valuation of the underlying components of a space tourism adventure. Unlike previous survey based approaches, the methods used here provide more accurate assessments of potential demand by not only providing realistic information about space tourism alternatives but comparing the potential choices to realistic alternatives.

The general findings of this study reveal that:

- Potential consumers do exhibit price sensitivity. At a price of $50,000 approximately 20 percent of people would opt for a sub-orbital space flight. Above $200,000 this number is halved to 10 percent.
- Potential Australian consumers prefer American and Australian operators to those from Japan, Germany, the UK and Russia.
- Potential consumers are affected strongly by the safety record of an operator.
- The vertical rocket launch is the preferred mode. A rocket plane is the least preferred mode of reaching space.
- Males and younger individuals are more likely to take a space tourism adventure.
- There is a strong relationship between asset ownership and space tourism choice. The effect of assets is stronger than the effect of income.
- Orbital space tourists are far more “thrill seeking” than other space tourists. Some space tourism adventures are simply not stimulating enough for these individuals.

The results presented here are a snapshot of a more complex segmentation modelling that not only examines the degree to which potential demand differs by individual but the complex combination of attributes associated with a space tourism adventure.

---- Future & Simple ----

http://www.futureandsimple.com

SPACE TOURISM

Descriptions

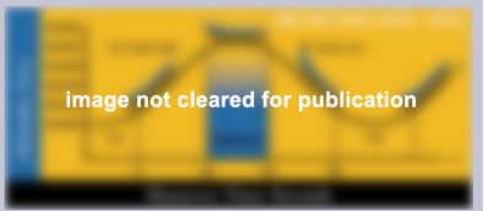
High-Altitude Jet Fighter Flights

Several commercial operators today offer the general public the opportunity to experience the exhilaration of flying aboard a jet fighter. Such experiences are available in several countries including, for example, Australia (flying a British Aircraft Corporation Strikemaster jet fighter/bomber) and Russia (in a MiG-25 "Foxbat" jet fighter).

These flights can simulate air combat missions, and low-level strike attack missions. The experiences include a range of aerobatic manoeuvres or high-altitude flights at 3 times the height of Mt. Everest and 2.5 times the speed of sound. At an altitude of 80,000 feet, the daytime sky above is black and a translucent-blue hue hangs over the Earth's horizon which is distinctly curved.

Zero-G Flights

Astronauts and cosmonauts undergo part of their training on board zero-gravity flights. These flights, which use regular jet aircraft, simulate the experience of floating in zero gravity by flying a series of "parabolic" loops. Similar to the feeling on a roller coaster when one is at the point of lifting off the seat at the top of a hill, these flights enable a customer to actually float safely in the air inside an aircraft.



Such commercial operations are available to the general public today, for example in Russia using a modified Ilyushin 76 and the US in a modified Boeing 727.

Sub-Orbital Space Tourism

In October 2004, the first successful privately-developed sub-orbital spacecraft, SpaceShipOne, made two flights to an altitude of over 100 kilometres, which is the officially recognised boundary of space.

Sub-orbital spaceflight occurs when a spacecraft ascends to at least 100km, floats in space for several minutes at the highest segment of the flight, and then descends to Earth. The speed and altitude involved is sufficient to reach space but is not sufficient for the spacecraft to circle the Earth in orbit continuously (as do the Space Shuttle and the International Space Station).

During a sub-orbital flight passengers experience a rocket-propelled ascent at several times the speed of sound. As the spacecraft ascends, the region of the Earth's surface that can be viewed from the spacecraft increases considerably. The sky turns a deep blue and eventually becomes black. The curvature of the Earth's surface is very clear and the thin atmosphere is readily apparent. Passengers view the Earth from space as astronauts see it.

When the rocket engines are switched off, several minutes of zero-gravity or weightlessness are experienced. Loose objects float within the spacecraft. The zero-gravity experience ends when the spacecraft begins its controlled return to Earth, but the experience of viewing the Earth from this very high altitude continues for some time longer.

Orbital Space Tourism

In April, 2001, Mr. Dennis Tito became the world's first space tourist. As a paying passenger onboard a Russian Soyuz rocket, he accompanied a crew to the International Space Station where he spent several days with the other astronauts and cosmonauts before returning to Earth in a Soyuz capsule. Prior to the flight he spent several months training at the Russian cosmonaut training centre. Mark Shuttleworth became the 2nd paying space tourist when he repeated much the same experience as Dennis Tito. The 3rd orbital space tourist has begun training for an April 2005 launch.

Orbital space tourism takes paying passengers a step further than sub-orbital flights. It uses powerful rockets that can reach the speeds and altitudes required to reach low-earth orbit.

Orbital tourists are currently limited to stays of several days at the International Space Station operated by NASA and the Russian Space Agency, however there are plans to design and build commercial space stations and "space hotels".

To proceed to the next screen, please click the 'next' button:

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1. Introduction

Over forty years ago Yuri Gagarin made the history books as the first person in space. He was soon followed by other pioneers like John Glenn (the first American to orbit the earth), Gherman Titov (the first person to spend an entire day in space), Valentina Tershkova (the first woman in space), and Neil Armstrong and Buzz Aldrin (the first human beings to set foot on another world). Today, space is slowly being opened to another sort of adventurer, the “Space Tourist”. Dennis Tito, Mark Shuttleworth and Gregory Olsen became the first private individuals to enter space on a “fee for services” basis, each paying US$20 million for an orbital adventure at the International Space Station, courtesy of Space Adventures and the Russian Space Agency.

Companies like Virgin Galactic, a space tourism venture backed by Sir Richard Branson’s Virgin Group, have already begun work shaping a space travel market. Recent events such as the Ansari X Prize[1] have proven that private space tourism is technologically feasible. However, there are many technologically feasible products and services that have proven to be spectacular failures in the marketplace. Some lose because of standards (Sony's BetaMax), some are too early in the market (Philips' CD-I) and some are just not mature enough technologically (Apple's Newton).

What these earlier failures reveal is that making space tourism into a success story will also require a complex mixture of marketing savvy and good luck. Space tourism operators need not only address issues of cost, time and risk but also understand how other variables (for instance spacecraft type, duration of flight and weightlessness, launch location and so on) will affect customer perceptions and demand. Assessing customer expectations and needs is critical, with commercial feasibility hinging on marketing research to understand consumer willingness to choose and pay. Furthermore, space tourism, like any other commercial product, does not exist in a competitive vacuum. Adventure seekers have a number of alternative space tourism-like options, such as Zero-G flights. They might alternatively prefer to wait for the advent of even more exciting or less expensive sub-orbital or orbital adventures.

Space tourism is still in its infancy and forecasting the likely demand for various types of product and service options poses specific challenges. Space tourism is a ‘new-to-the-world’ (or more accurately ‘new-to-out-of-the-world’!) product that entails new risks and new combinations of old risks. In addition, few individuals know what space tourism entails, as they have no experience with the product or the potential providers. They do not understand the physically demanding nature of the potential products nor can they contemplate the risks accurately. Finally, for all intents and purposes, the space tourism industry does not yet exist and there are no industry standards that allow people to make comparisons between relatively standardized product options. To take a historical example, the advent of space tourism is similar to the advent of the automobile when different engine and vehicle types competed against one another until the internal combustion engine began to dominate the industry as the de facto standard.

For those currently endeavouring to establish an industry, those contemplating entering the industry, and national and international policy makers helping to shape the industry, there is a need for more accurate and operational information

[1] In October 2004, the Ansari X Prize competition awarded US$10 million when *SpaceShipOne* was the first privately-constructed, manned spacecraft to travel 100 kilometers above Earth's surface considered the edge of space) and then to return to space within two-week deadline to demonstrate reusability.

to guide decision making. Estimates are that SpaceShipOne cost an estimated $20 million to $30 million to build, independent of the maintenance of the spacecraft and the future development of a commercial service. The level of necessary investment can be seen in the announcement in February 2006 that Space Adventures has agreed to a $256 million project to develop a commercial spaceport in the United Arab Emirates.

It is at this point where our research provides unique value. As the first step in a very detailed and sophisticated investigation into consumers' preferences for various types of space tourism, we focus on providing specific monetary estimates of the demand for various space tourism options. Applying a unique methodology developed specifically by the members of the research team, we are able to address the issue of demand forecasting when there is also no past data on which to base forecasts and consumers have little to no experience with the emerging industry or the products and services potentially offered.

Our specific concerns target a critical range of questions:

- What is the demand – price relationship of various space tourism options?
- What is the risk – demand relationship of various space tourism options?
- What characteristics will make a 'value for money' experience?
- Which customer segment(s) represent the best market for the various space tourism options in the short and long term?

2. What Do We Know So Far?

The interest generated by the advent of space tourism has lead to a number of studies. This past research is still in its infancy, and uses rather simplistic methods, often failing to produce valid and accurate estimates of the scale of demand. We examine a number of previous attempts to answer such questions below.

In order to estimate the demand for space tourism, Collins, Iwasaki, Kanayama and Ohnuki (1994a and 1994b) and Collins, Stockmans and Maita (1995) looked at a sample of 3,030 people in Japan. They found that 45% of those over 60 years of age, and nearly 80% of those under 60 would like to go to space, with women's interest lagging behind by five percentage points. A look at the most popular activities revealed 'look at Earth' and 'space walk' as favourites (although one might wonder how the 45% of people over 60 could physically deal with a space walk!), followed by 'astronomical observation', 'zero G sport' and 'zero G experiments'. In addition, about 20% were prepared to spend a year's pay or more on space tourism and expressed most interest in travel of several days' duration.

Collins *et al.* (1995) followed up their Japanese study with the same survey conducted in the US and Canada. Here they found that 61% of the sample was interested in space tourism, with women interested 10 percentage points less than men. In addition, slightly more than 10% stated that they were prepared to pay a year's salary or more. The North American study also revealed that most people were interested in stays of several days or longer, something that none of the current potential space tourism companies (other than the Russians) would be able to offer and would cost more than the year's salary of most survey respondents (the going price being $20 million).

Further US studies found that 34% of the individuals surveyed were interested in a two-week vacation on a space shuttle, and 7.5% would pay US$100,000 or more (O'Neil *et al.* 1998). Roper and Starch Worldwide (1999) also found that over 35% were interested in a 6-day trip to the moon; again an example of the lack of understanding of most individuals as to what is technically feasible for novice tourists.

The Collins *et al.* survey was used by Abitzsch (1996) to estimate demand in Germany. He found that 43% of Germans were interested in space travel. A survey of British respondents replicated the Collins *et al*. surveys (1994a, 1994b, 1995, 1996) and found that 5% of British respondents showed interest (Barrett 1999). Similarly, Crouch and Laing (2004) found that 58% of Australians would like to travel into space, with younger and male respondents, and those with greater risk-taking tendencies, significantly more interested.

The Futron Corporation (2002) surveyed 450 wealthy Americans in a study for NASA and found sub-orbital space travel could reach 15,000 passengers annually by 2021, with revenues in excess of $700 million — a rather risky prediction given that it assumes such trips can be priced at less than $50,000. Unexpectedly, they find half of the respondents to be indifferent to travelling in a privately developed craft with a limited flight history versus a government-developed alternative.

Although these studies are interesting, they reveal little about actual consumer demand or potential consumer behaviour, and they provide little operational data to inform decision makers about which options to provide, when to provide them, and to whom they should be provided at what price. This is evident from the unrealistic responses to a number of the survey questions. For example, the fact that 60 year-old+ individuals might want to take a space walk or that individuals believe that they want to take a trip to the moon has little basis in current reality, but instead reflects an almost ‘Star Trek’ mentality as to what it means to be in space. Similarly, it means little that an individual indicates that they would pay up to a year’s salary for such an adventure, when most individuals are in no position to generate such cash and when the preferred options (such as the trip to the moon or two weeks in the space shuttle) would cost very much more.

So how can we study, and what can be said about, what customers want? In what follows we provide a more complete approach to studying the demand for space tourism that accounts for:

(1) The lack of information that people have about space tourism options,

(2) How individuals value the components of a space tourism experience,

(3) How individuals react to the risks associated with space tourism, and

(4) The extent to which consumers of different types react to different space tourism options.

This report is not intended to be exhaustive and more detailed information is available from the research team. Its purpose is to present an overview of the types of investigations now possible for estimating the demand for space tourism, or indeed any radical new technology. The summary of our findings is meant to draw a preliminary picture of the market. We hope that this document will provide opportunities for a more comprehensive research agenda involving international demand for space tourism.

In what follows we outline the methods employed to elicit and measure individual preferences for space tourism options (section 3), provide an overview of who was studied (section 4), present our demand results (section 5), examine how these results vary based on customer profiles (section 6), and draw some empirically based conclusions from the results (section 7).

3. Eliciting and Measuring Customer Preferences for Space Tourism

In attempting to estimate the demand for space tourism, research to date has largely focused on price and price sensitivity; and it has done so in unrealistic environments where it is uncertain what space tourism experiences will actually entail. Although price is an obviously important factor in a consumer's decision, it is also important to recognize that demand for space tourism will be a function of all the other factors that make up the experience, such as: *journey duration*; *conditions aboard the spacecraft*; *available activities/experiences before, during and after the flight*; *perceived levels of safety*, etc.

So, demand must be estimated as a function of the price of various options, their risk, the competitive dynamics between the various ventures and different forms of space tourism, the characteristics and design attributes of different options available, as well as situational factors (e.g., the economy, confidence in the future, etc). It also needs to take into account information that consumers have about exactly what is involved in a space tourism experience, and it needs to be able to profile who is likely to choose what (when, and how often).

In order to satisfy these requirements, we employ a discrete choice modelling (DCM) approach that allows us to understand the independent contributions of many components that make up a space tourism experience; e.g., price, method of transport or country of origin, consumers' preferences for particular configurations of the experience and so on. DCM involves conducting a 'choice experiment' in which the components (variables) of interest are experimentally manipulated. Pioneered by Louviere and Woodworth (1983), choice experiments are widely used to evaluate product preference and willingness to purchase by designing choice scenarios that closely simulate the choices that consumers face in real markets. In the space tourism context such choices feature many attributes of potential interest.

A further challenge to market research is the fact that space tourism is relatively new and unfamiliar to most people. So, consumers have little knowledge on which they can base their choices. We use information acceleration (IA) techniques pioneered at MIT (Urban *et al.* 1997), and expanded upon by the Future Choice Initiative (Devinney, Louviere and Coltman, 2005), to construct sets of future scenarios that allow consumers to better understand situations in which they will make future decisions. IA uses information and multi-media technology to 'accelerate' consumer learning and enable choice surveys to include a wide array of information, features, risk/benefits and context that consumers need in order to make informed decisions about future services.

Thus, we constructed a nested choice experiment where context (availability of options like high altitude, zero-g flights, sub-orbital and orbital flights) and information preceded standard choice experiments. There were three parts to the survey:

(1) An **information section** outlining the various forms of space tourism. The intent of this section was to provide participants with as much information as possible so that they could make informed decisions about the options. The information provided was visually rich, increasing the salience of the specific experiences that people might expect to receive and increasing their understanding and comprehension of what such an experience may involve.

(2) Two decision sections that contained 8 sets of 3 hypothetical **space tourism products under two different scenarios**.

   a. ***Scenario 1*** focused in detail on zero-gravity flights and accounted for the impact of high-altitude jet fighter flights and sub-orbital space tourism.

   b. ***Scenario 2*** focused in detail on sub-orbital space tourism and the accounted for the impact of zero-g flights and orbital space tourism.

   Each choice set represented a future situation in which participants were offered three competing options.[2] This allowed us to develop a preference ordering for each participant within each type of scenario.

(3) A number of **demographic and lifestyle** questions along with a scale aimed at understanding **thrill seeking** tendencies.[3] The intent of this section was to generate data to enable us to examine segmentation and targeting possibilities.

The choice options (point 2 above) offered to participants were described by more than 35 variables (called 'attributes'). Each attribute combination represents a possible space tourism product on offer, and participants choose one of the products on offer in the set, or none of the products. Attributes for each form of space tourism were selected in consultation with our expert advisory board. This approach recognises explicitly that there is not one possible space tourism option, but, in reality, many millions of possible options that are combinations of the attribute values.

Table 1 outlines the attributes used to describe the zero-g and sub-orbital space tourism options.

Possible space tourism products were manipulated experimentally, with each attribute being described by 2 to 16 levels (values that attributes can take on, such as various levels of medical testing required). For instance, the price for sub-orbital space tourism was varied over 8 levels ranging from US$10,000 to US$220,000. This allows us to assess the role that each individual attribute plays in influencing people's choice amongst the four options. The appendix presents some details on a selection of the attributes and levels used in the study. The entire process is illustrated in Figure 1.

Each individual responded to each set of space tourism products by answering three questions:

(1) Which of the three options did they prefer most?

(2) Which of the three options did they prefer least? and,

(3) On which of the three options would they, realistically, spend time and money if they were available in the next 12-24 months (or would they spend no money on any of them)?

What distinguishes this study from prior surveys is that it addresses the issue of how people choose not only within an option — e.g., sub-orbital space tourism or zero-g flights — but how they would choose between options. In addition, the approach accounts for the composition of the specific options being chosen,

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[2] The scenario provides an assessment of the role that the attributes play in influencing choice between, but not within, each of the four types. It would, however, be straightforward to design a similar but different choice experiment that examined choice among options within one of these types of space tourism options, such as sub-orbital space tourism.

[3] The scale used was Zuckerman's 'Thrill and Adventure Seeking' Scale. Section 6 describes this scale further.

rather than relying on potentially ill-conceived notions by survey respondents about what space tourism actually entails.

Table 1: Zero-g and sub-orbital attributes

Zero-g Attributes	Sub-orbital Attributes
Price of flight experience	Price of flight experience
National identity of operator	National identity of operator
Stringency of physical requirements	Stringency of physical requirements
Safety standard of this venture as judged by independent experts	Safety standard of this venture as judged by independent experts
Safety history of other ventures	Safety history of other ventures
Experience of operator and safety record	Experience of operator and safety record
Licensed status of operator	Licensed status of operator
Insurance coverage	Insurance coverage
Opportunity to conduct Zero-G activities/games	Opportunity to conduct Zero-G activities/games
Further educational enhancements	Further educational enhancements
Total number of parabolic loops and total time in Zero-G	Total duration of sub-orbital flight
Aircraft type	Launch craft / sub-orbital craft / return craft combination
Airport type	Launch location type
Proximity of airport for departure	Launch and return location geography
Passengers per assisting crew member	Number of accompanying passengers
Zero-G space per passenger	Zero-G floating
Duration of pre-flight training	Parachute training required
	Launch vehicle training
	Return location
	Seating and viewing arrangements
	Overall duration of the space experience training and flight package
	Medical testing
	Anticipated wait before commercial services become available
	Terms of withdrawal by customer

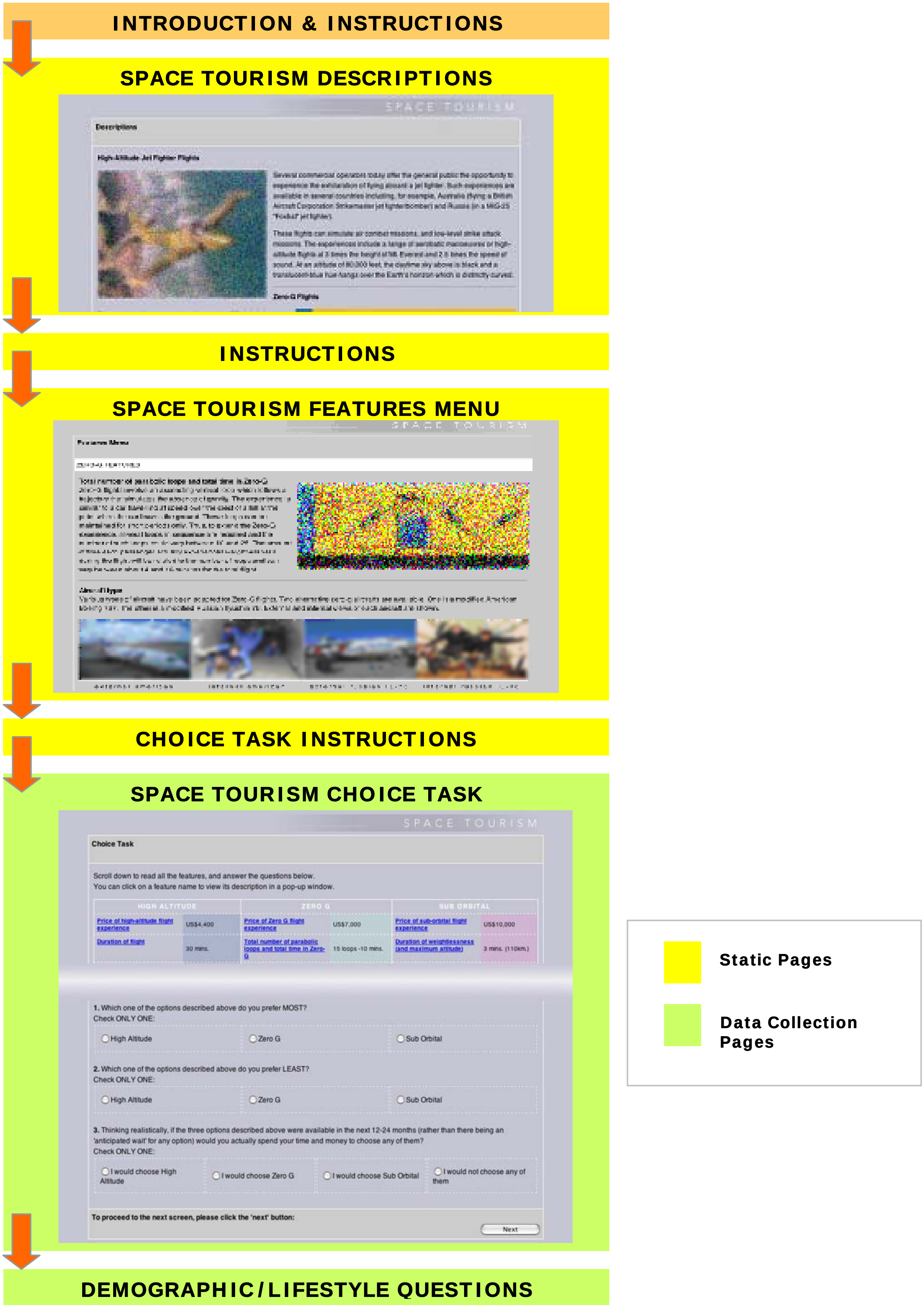

Figure 1: A summary of the experimental process flow chart

4. Who Was Studied?

The study collected survey data from 783 members of an online panel operated by PureProfile in early 2005. PureProfile is a permission-based panel provision service. The participants were sampled to be broadly representative of the Australian general population, with some over-sampling of higher income individuals (those with incomes above $100,000) and/or high net worth individuals. The composition of this sample is described in more detail below in Exhibits 1-5

The sample was broadly representative of the Australian population based on gender (see Exhibit 1) and age. The average age in our sample was 41 years (median = 39 years), with 29% of people between the ages of 26 and 35 (see Exhibit 2). Participants' education levels are depicted in exhibit 3, with over 70% of participants holding at least an undergraduate degree and almost 25% holding a postgraduate degree or higher qualification. The high university representation is reflective of our emphasis on studying more well off potential consumers.

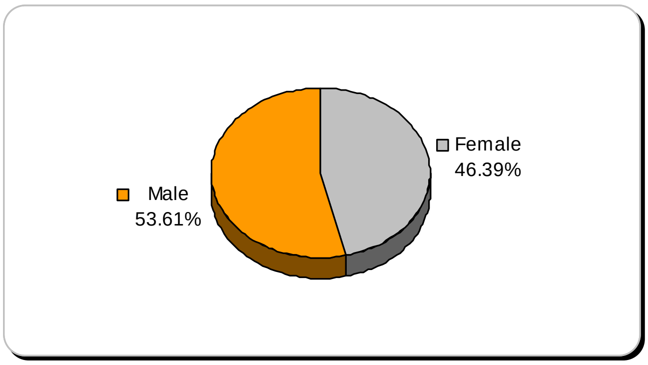

Exhibit 1: Survey respondents by gender

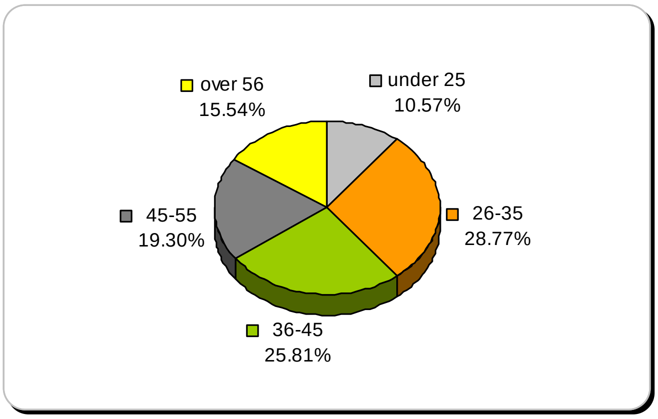

Exhibit 2: Survey respondents by age (in years)

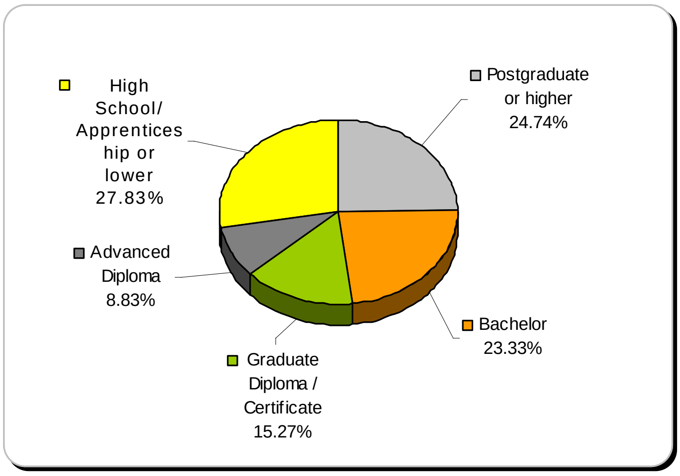

Exhibit 3: Survey respondents by education

As participants opted into the survey based on their interest in the topic, it is not surprising that our sample consisted of predominantly high income and/or high net-worth individuals. This was also affected by the fact that we over sampled this group to ensure that we received enough individuals in this group for meaningful segmentation analysis. The median household income was $91,000, with the lowest being $20,800 and the highest $286,000. Income brackets are presented in Exhibit 4, revealing that about 45% of our participants had an income of over $100,000. Over 37% of participants have total assets (including value of residence, value of investment property, superannuation, investment portfolio) of over $1,000,000.

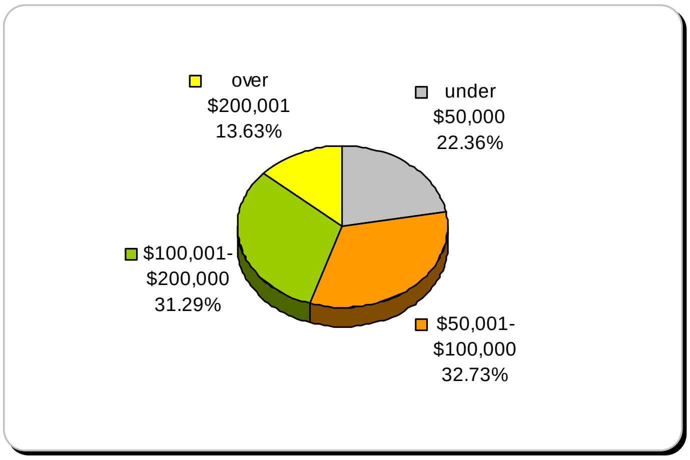

Exhibit 4: Survey respondents by income

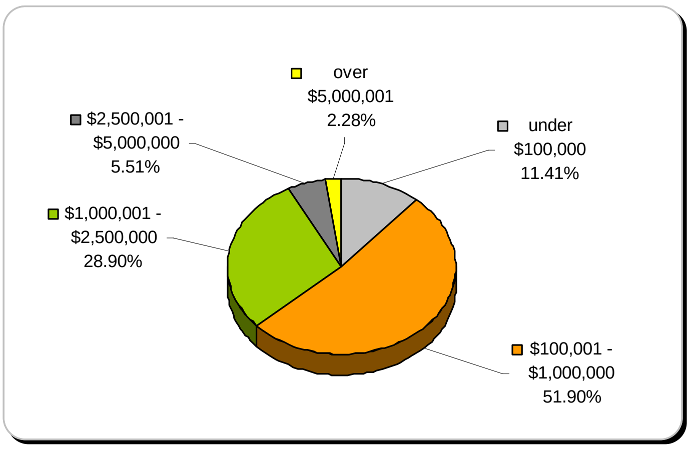

Exhibit 5: Survey respondents by assets owned

5. The Demand for Space Tourism Options

Our approach allows us to determine:

(1) The likelihood that an individual will choose a specific space tourism option based on the combination of the features offered,

(2) How this choice will vary based on the price and composition of competing options.

(3) How this choice will vary based on the characteristics of the individuals making the choice.

We first report the average number of choices in the experiment across all scenarios. This reveals the average likelihood of choosing one of the options independent of all specific features. Hence, these averages do not reflect differences in survey responses when the various feature level combinations are varied. Overall, we see patterns that are consistent with expectations but well below the sorts of numbers reported in the previous studies mentioned earlier.

SPACE TOURISM CHOICE	Probability of Choice
Zero-G	35.3
Sub-orbital	15.9
Orbital	11.1
None	37.7
Total	**100**

Table 2: Choice frequencies

What is more important from our perspective is the degree to which these choice probabilities vary based on the underlying features and the price of the different options. The most direct comparison is to examine what the price effects are. Table 2 shows the price profiles of the options when compared with the price of a sub-orbital trip. As expected there is a negative relationship between the price of sub-orbital space tourism and the demand for that option—the probability of choice drops from just under 30% at a price of $20,000 to just over 10% at a price of $200,000. As expected, the likelihood of choosing none of the space tourism alternatives increases as the price of sub-orbital space tourism increases, as does the likelihood of going on a zero-g flight. Interestingly, the demand for orbital space tourism decreases with the price of sub-orbital space tourism; however, the overall change is negligible, leading to the conclusion that the cross price effect of sub-orbital space tourism on the demand for orbital space tourism is effectively nil.

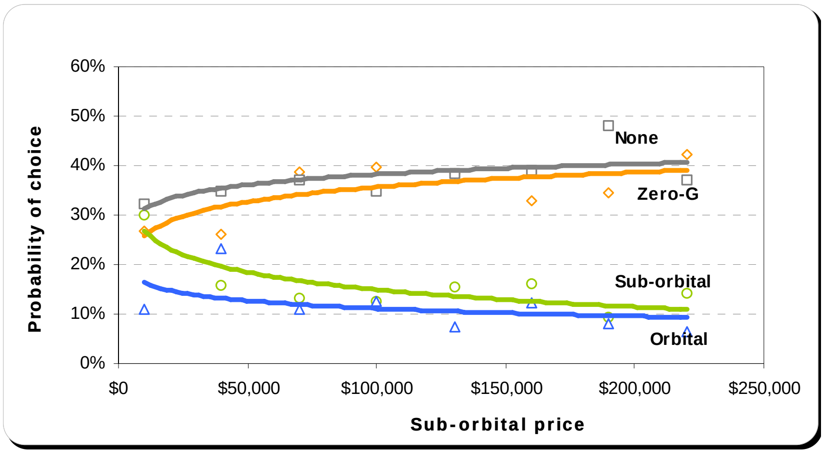

Exhibit 6: Price effect on probability of choice

We can also identify other attributes that drive sub-orbital space tourism choices. For instance, sub-orbital flight experiences may be offered in various countries by operators with different national identities. There were seven alternatives for the national identity of the firm which designed, owns and operates the sub-orbital flight service. They represented possible or likely ranges of variation of interest: US, Russia, China, UK, France, Germany, Japan and Australia. Our Australian sample preferred Australia and the USA as the country of operator and reacted negatively to countries such as Russia and Japan (see Exhibit 7).

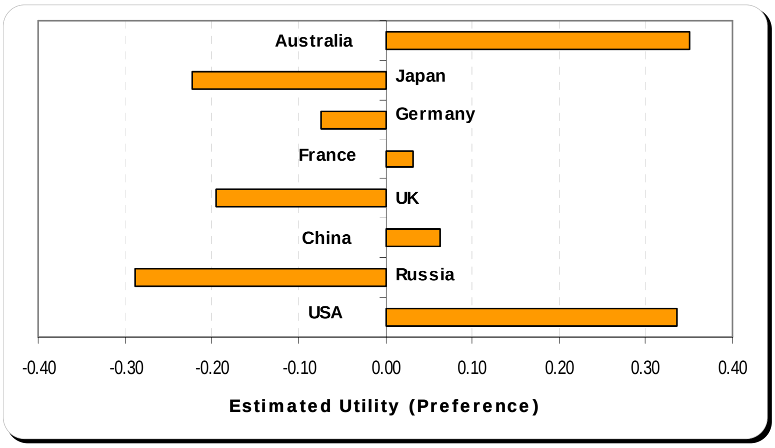

Exhibit 7: Country of operator effects

In contrast, there were no significant effects with regard to the launch or return facility or location. The different options included airports, government space ports, commercial space ports, or a facility located at a remote, unpopulated site, as well as return landing at the same launch site or 5 miles, 20 miles or 100 miles downstream.

Furthermore, we found direct evidence that the risks involved play an important role. The amount of experience (in years) that a firm has in operating commercial sub-orbital flights and the occurrence, if any during this period, of fatal accidents, impact customer perceptions of the risks associated with the adventure. Alternatives ranged from new operators with no previous experience to ventures with 1, 5 or 10 years of experience and different safety histories of the venture in terms of fatal accidents. If there have been few harmful incidents, then the likelihood of choosing an operator increases approximately linearly in years of operation (see Exhibit 8). The opposite happens in the case of several harmful incidents.

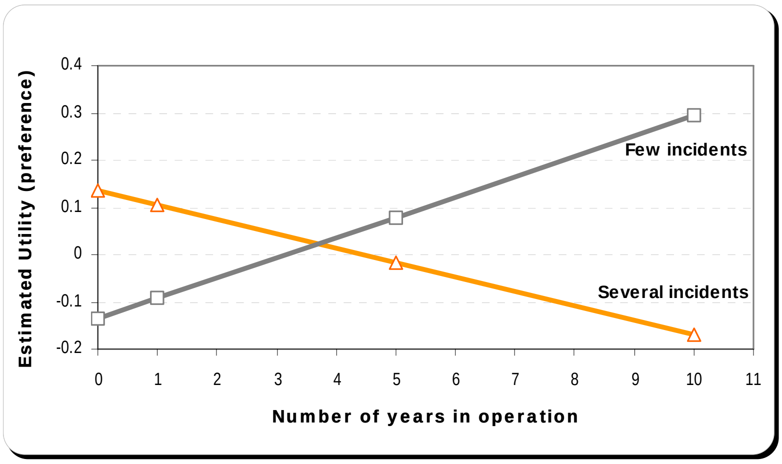

Exhibit 8: Safety record/incident effects

In contrast, the safety history of other ventures, as well as the safety standard of ventures as judged by independent experts, did not impact choices significantly. Additionally, the license status of the operator had a significant impact, with individuals preferring those licensed from several licensing authorities including the US Federal Aviation Administration (FAA) and NASA as opposed to licensing only from the launch site local authority.

Various types of sub-orbital spacecraft concepts or designs exist, which vary significantly in terms of their launch and return configurations. Four options were considered: (1) plane and detachable rocket, (2) vertical rocket launch and parachute capsule return, (3) balloon ascent, detachable rocket and capsule return, and (4) rocket plane.[4] With regard to the type of craft used, a vertical rocket launch leads to significantly more likelihood of choice, while a rocket plane has a dramatically lower acceptance rate. What is interesting about these results is that the first major private space tourism company, Virgin Galatic, is using a rocket plane configuration. One implication of these results is that they will need to overcome a potentially significant obstacle in terms of perceptions of that delivery mechanism.

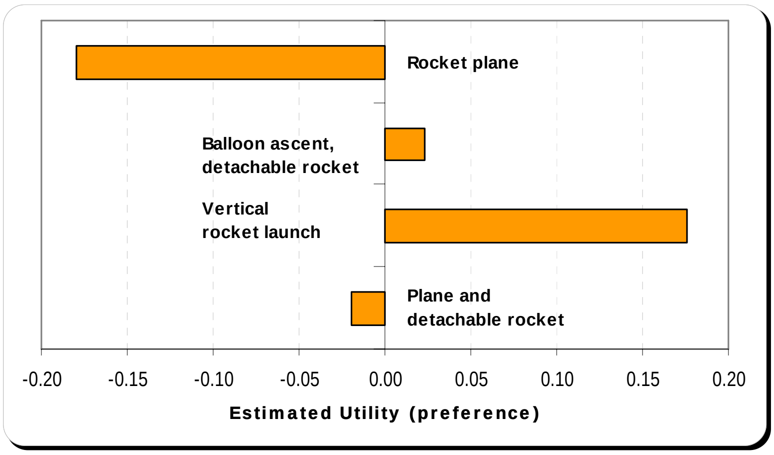

Exhibit 9: Type of craft effects

The overall duration of the space experience had little effect on the choices, but the type of Zero-G floating experience was a significant driver. Individuals preferred significantly to unbuckle their seat belt and float freely in zero gravity compared to being constrained to a seat.

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[4] The different ascent types are: (1) Plane and detachable rocket – consists of a specially designed, winged plane and detachable rocket. The plane takes off horizontally and reaches a high altitude before the rocket itself detaches from the plane, ignites its rocket engines and accelerates into space. The plane returns to land while the rocket ascends to its maximum altitude. The rocket then begins its descent. As the rocket is equipped with a specially designed tail and stubby wings, the rocket is able to fly and land horizontally. (2) Vertical rocket launch and parachute capsule return – consists of a launch and return design similar to early rocket designs. A conventional rocket is launched vertically from a launch pad. The rocket engine ignites on the launch pad and accelerates the rocket into space. The landing method involves use of a return capsule and landing gear, and controlled descent using parachutes. (3) Balloon ascent, detachable rocket and capsule return – consists of a rocket which ascends to a high altitude using a large helium balloon. When the balloon reaches the required altitude, the rocket is detached from the balloon, the rocket engine ignites and the rocket accelerates into space. The descent of the return capsule is controlled using a cone that inflates around the capsule. At a height of 25,000 feet above the Earth, a parafoil is deployed that enables a controlled return to Earth. An inflated cone softens the capsule landing. (4) Rocket plane – consists of a rocket plane that takes off horizontally using jet engines like a normal plane. At an altitude approximately that of a conventional plane, rocket engines ignite to accelerate the plane into space. The rocket plane then re-enters the atmosphere using its wings to control its re-entry and descent and eventually lands horizontally.

The extent of training required by passengers prior to travelling on certain sub-orbital spacecraft operations significantly impacted choices as well. Less demanding training was preferred to extensive training involving widespread familiarity with equipment, facilities and instruments.

Apart from basic training, additional educational enhancements may be offered by various operators in order to extend the customer experience. However, this did not seem to provide much value. Reactions by potential users varied by type of presenter – with negative reactions to presentations by a space scientist – to no significant effect for presentation by NASA astronauts. Basically, these additional product add-ons have little influence on choosing a space tourism experience between the four alternative forms surveyed.

Overall, we found that many potential space tourism product attributes had minimal or limited impact on the likelihood of choice. Different seating and viewing arrangements or various numbers of additional passengers on the same flight have trivial or minor impacts. This also is true for insurance coverage or the terms of withdrawal for the passengers. A number of these attributes and their estimated influence are shown in Exhibit 10.

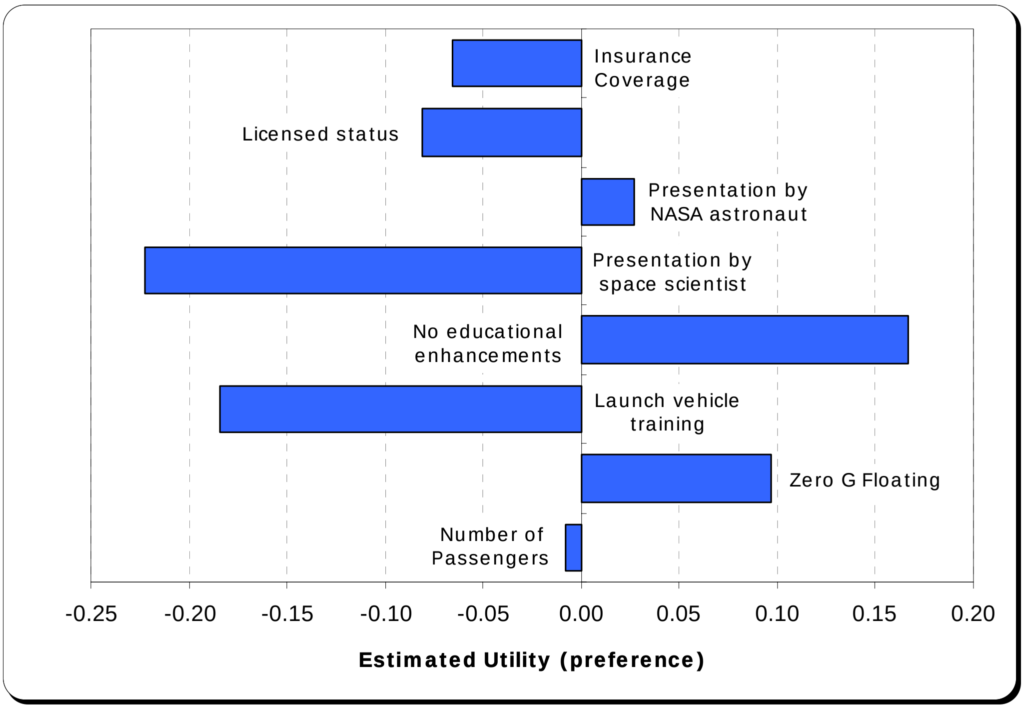

Exhibit 10: Space Tourism Adventure Attribute effects

6. The Role of Demographics and Lifestyle

People are not the same, so we expect to find significant differences in the types of people who might choose to engage in space tourism. Prior work suggests, for example, that women are less likely to want to go into space, and that there is a relationship between an individual's degree of risk aversion and activities like space tourism. Hence, we queried people about the leisure and adventure activities they have undertaken, what sports and leisure equipment they own, their past travel activity and whether or not they have engaged in exceptional activities such as being in the military or holding risky occupations. In addition, we surveyed their attitude toward risk and asked a number of demographic questions (i.e., gender, age, household income, education, property values and other assets, etc).

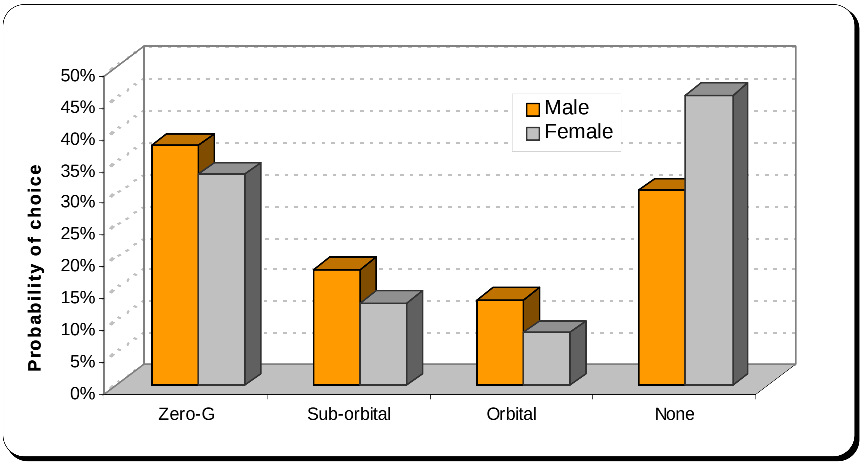

Exhibit 11: Space tourism choice by gender

Similar to prior findings, there are significant gender differences in the desirability of space tourism related activities (see Exhibit 11). Overall, women are less likely to choose any space tourism option, and correspondingly more likely to choose none of the options. Women display approximately 15 percentage points less demand for these activities than males, regardless of the activity.

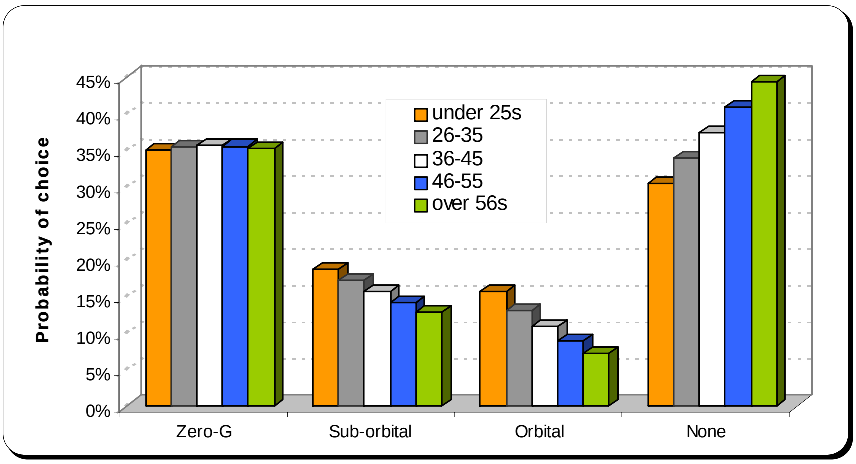

Exhibit 12: Space tourism choice by age

There also are significant age differences in the demand for the riskier space tourism options. Although there is no age effect for zero-g flights, there is a significant decline in the likelihood of choosing orbital or sub-orbital space tourism options with age. The effect of age is stronger for orbital space tourism than for sub-orbital space tourism. Although there is an approximate 35% reduction in the probability of choosing to go on a sub-orbital trip when one compares the youngest to the oldest age group, this percentage increases to 50% for orbital space tourism trips.

As one might expect with expensive 'luxury' goods, space tourism options exhibit income and wealth effects. As revealed by Exhibit 13, all three options show an increase that is approximately proportional (meaning that no one option seems to have a bigger percentage increase as income increases). However, when one examines total assets there are now distinct differences in the way the respondents react to the three options (see Exhibit 14). Zero-g flights are now less likely to be chosen and sub-orbital space tourism increases strongly. Indeed, the absolute increase based on income for sub-orbital flights is greater than for orbital flights.

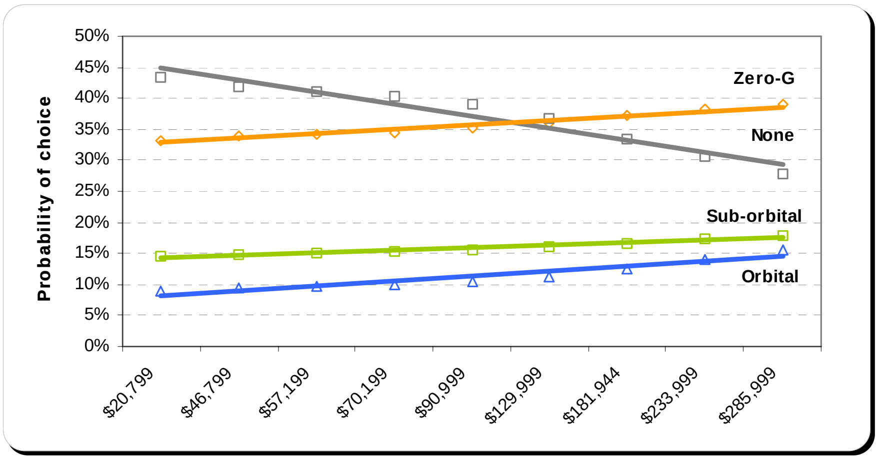

Exhibit 13: Space tourism option choice by income

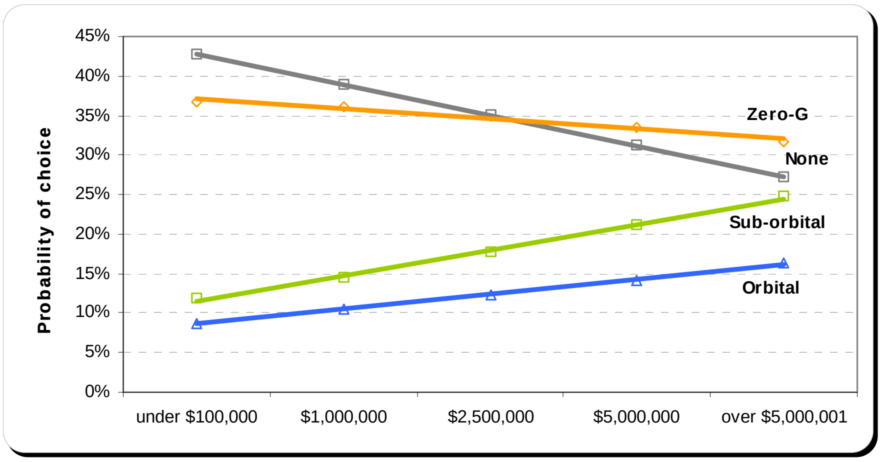

Exhibit 14: Space tourism choice by total household assets

Given that space travel is an inherently risky activity, we included a number of lifestyle questions designed to further our understanding of how attitudes towards risk are potentially linked to space tourism choices. For example, risk or thrill seeking behaviour is revealed through items such as the number of relatively high-risk activities respondents engaged in (e.g., snowboarding, scuba diving, mountain climbing) and how many risky 'toys' they own (e.g., motorcycles, guns, airplanes). Exhibit 15 shows a rather interesting set of relationships. As one might expect, the more risky 'toys' a person owns is strongly related to their likelihood of taking up an orbital space tourism adventure. However, more intriguing is the finding that those owning an intermediate number of toys, are less likely to take a zero-G or sub-orbital flight! The implication is simple; for these individuals the sub-orbital adventure is not enough of an adventure.

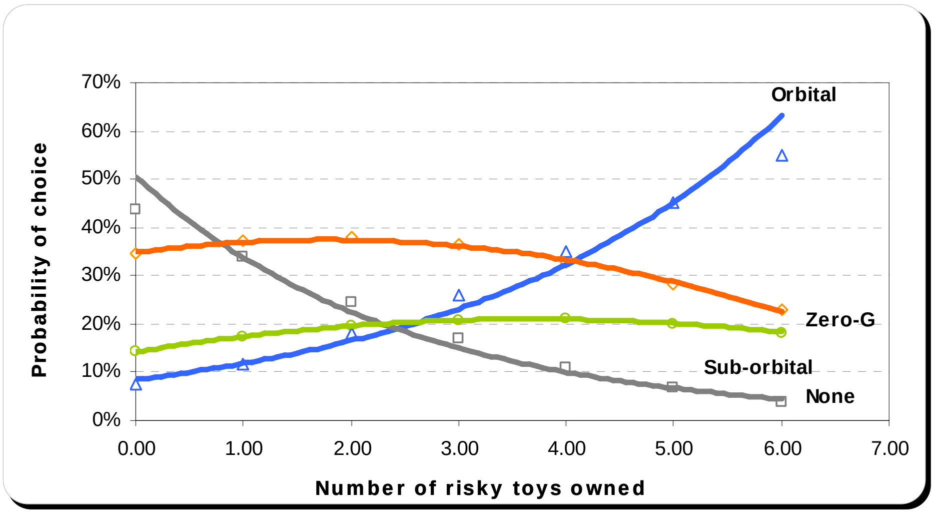

Exhibit 15: Space tourism choice by the number of risky 'toys' owned

Respondents also answered over 20 questions regarding travel behaviour and expeditions they have made, which ranged from the less risky (e.g., taking a local family holiday), through basic sightseeing in foreign lands to extremely risky (e.g., a mountaineering expedition to the Himalayas). More daring travellers have much higher probabilities of choosing sub-orbital space travel, although differences were not as notable as one might expect (see Exhibit 16).

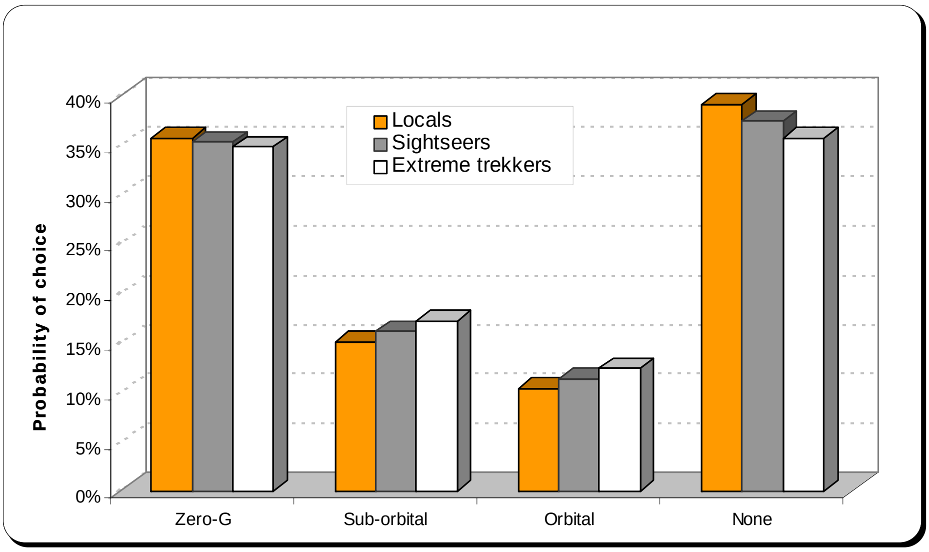

Exhibit 16: Travel effect on the probability of choice

More telling is the Zuckerman Thrill and Adventure Seeking (TAS) scale. Zuckerman (1994) defines sensation seeking as a trait describing the tendency to seek novel, varied, complex, and intense sensations and experiences and the willingness to take risks for the sake of such experience. His scale comprises 20 items requiring forced choice responses between two statements. Higher scores for TAS thus indicate a desire to engage in risky and adventurous activities and sports providing unusual sensations.

Our findings were consistent with the notion that individuals with a strong tendency to seek sensations will be attracted to riskier activities whereas individuals with weaker sensation seeking dispositions will tend to opt for lower risk choices. The effect can be seen in Exhibit 17.

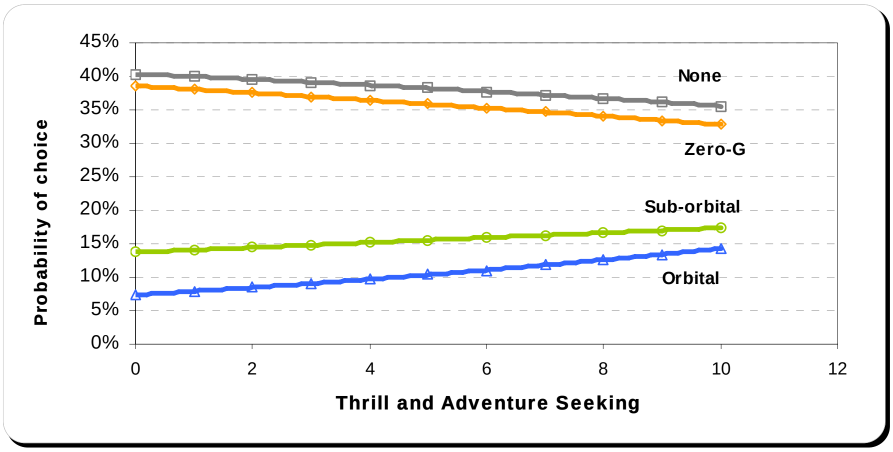

Exhibit 17: TAS effect on the probability of choice

Overall, a partial profile for the most likely customer for sub-orbital space travel is a younger male with high income /assets who already engages in risky activities and/or owns risky "toys". They also prefer vertical takeoff rockets over other vehicle options, are less likely to fly in Russian, British or Japanese vehicles, and react strongly to safety concerns. They are not hugely affected by price within the range of the prices examined although the relationship with price is intimately related with the asset structure of the potential customer. Although individuals with higher incomes have a greater preference for all modes of space tourism—from zero-g to orbital—those with higher net worth are skewed toward the sub-orbital option.

7. Conclusions and Opportunities for the Future of Space Tourism

Having demonstrated that private, commercial space tourism operators are capable of designing and building a sub-orbital space craft, the space tourism industry now faces new questions relating to how to sell the technological solution of space flight to an average (or slightly upscale) consumer. This implies that marketing research is crucial if commercial space tourism experiences are to be designed on the basis of a sound understanding of consumer choice behaviour.

The major challenge now is to conduct sound, reliable, state-of-the-art research for a product with no history, numerous potential product configurations and little consumer understanding of the benefits and risks. The results of this study show how one can deal with these challenges and obtain a good first approximation to the potential of space tourism based on sound consumer assessment.

We did this by addressing a number of issues. Firstly, we tackled the challenges encountered by previous research, and provided tools and techniques to assess the demand for space tourism. We used discrete choice models in conjunction with information acceleration techniques to illustrate the range of potential issues that can be tackled. In addition, the use of a robust multimedia platform allowed us to execute the IA experiments fast and economically. This also enabled us to go beyond traditional IA methods by having the ability to integrate multiple layers in our experiments, which in turn, allowed us to realistically simulate various market contexts. Finally, recent advances in the technique allowed us to go beyond static analyses and examine the evolution of customer intentions as the market evolves by making the experiments dynamic.

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APPENDIX – Examples of the Attributes for the Sub-Orbital Space Tourism Category

SUB-ORBITAL SPACE TOURISM		
Attributes		Levels
Price	1. Price of sub-orbital flight *Price of sub-orbital flight inclusive of training. Does not include the cost of getting to the airport where the sub-orbital flight departs. Assume US$1 = AUD$1.35 with prices potentially varying between US$10,000 to US$200,000.*	8 levels: US$10,000 / US$20,000 / US$30,000 / US$50,000 / US$75,000 / US$100,000 / US$150,000 / US$200,000
Availability	2. Anticipated wait before commercial sub-orbital services become available *Indicates whether commercial sub-orbital services are available at the present time or, if not, how long experts anticipate it will be before one or more such services are available to the general public in the future.*	4 levels: available now / available in 5 years / available in 10 years / available in 20 years
Duration	3. Duration of weightlessness (and maximum altitude) *Indicates (in minutes) how long each passenger actually experiences weightlessness during the flight, and the highest altitude reached. Space is officially designated to begin 100 kilometres above the Earth. Sub-orbital flights are therefore designed to exceed this altitude. Higher altitudes provide an increased view of the Earth's surface and extend the period of weightlessness. The duration of weightlessness and the altitude reached varies between 3 minutes and 110 kilometres and 10 minutes and 150 kilometres.*	4 levels: 3 mins. (110km.) / 4 mins. (120 km.) / 6 mins. (135 km.) / 10 mins. (150km.)
Training and testing	4. Duration and stringency of physical training and testing *The sub-orbital operator will set certain requirements and place physical demands on passengers in terms of training, testing and preparation. The level of these requirements and demands in terms of their duration and stringency varies between 3 days of low degree-of-difficulty training and up to 4 weeks of high degree-of-difficulty training.*	4 levels: 3 days of low degree-of-difficulty training / 1 week of moderate degree-of-diff. training / 2 weeks of high degree-of-diff. training / 4 weeks of very high degree-of-diff. training

For More Information and additional details and results from this study are available from the three lead investigators:

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