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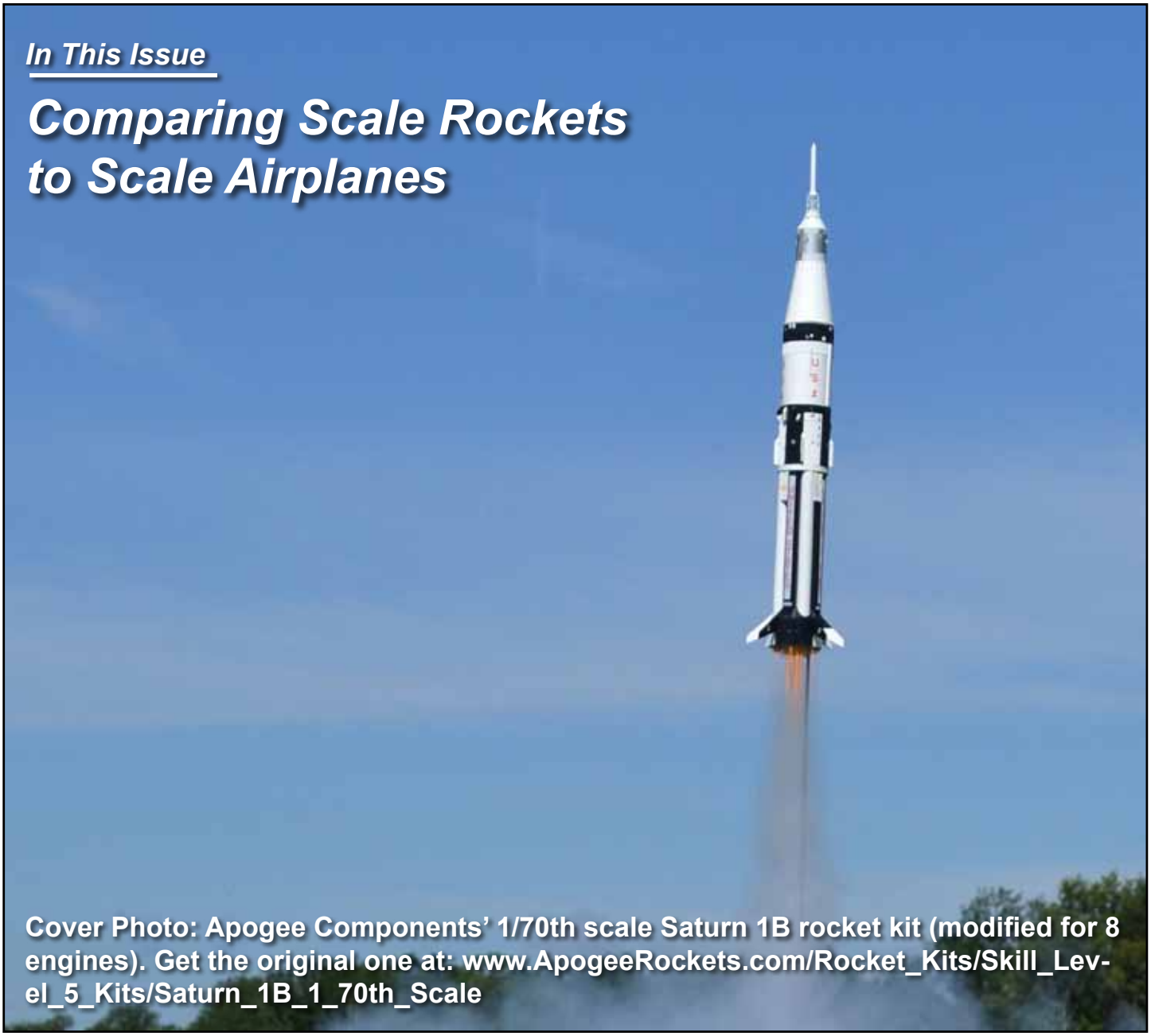
NEWSLETTER

In This Issue

Comparing Scale Rockets to Scale Airplanes



Cover Photo: Apogee Components' 1/70th scale Saturn 1B rocket kit (modified for 8 engines). Get the original one at: www.ApogeeRockets.com/Rocket_Kits/Skill_Level_5_Kits/Saturn_1B_1_70th_Scale

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Comparing Scale Rockets to Scale Model Airplanes

By Stuart Lodge

{Editor's Note: Stuart Lodge is an FAI Scale Judge from the United Kingdom. This article gives us some insight on how scale model rockets differ from scale model airplanes, particularly in world-class competition events.}

Stuart Lodge preps V-5-V Vertikal at the 2006 Ljubljana World Cup for Space Models.

Scale rockets mimic scale model aircraft, so how can there be any difference? What's identical is that the satisfaction of building/flying a scale replica is unequalled and it's what the general public loves to see. Let's scrutinise the two generics, as there are some focal contrasts. First up then…

Historical snapshot

Full-size aircraft came of age in the 20th Century ~100 years ago. Rockets were invented by the Chinese – in the wake of the evolution of Gunpowder - in the 13th Century. These were used as rudimentary weapons, Pien Ping city being sieged with rockets in 1232. Ceremonial rockets were popular throughout, but it took the latter 19th and 20th Centuries to develop rockets as effective weapons' systems, research devices and payload/satellite carriers.

Compare & Contrast

Virtually all Aircraft from 1900 onwards (>99.9%) – save cruise missiles and military drones – were conceived to carry people, from a single pilot to hundreds of passengers. Rockets – with about a dozen exceptions – are not people carriers; Exceptions include: Vostok, Soyuz, N1, Energia-Buran (former Soviet Union & Russia); Mercury Redstone, Atlas Friendship 7, Gemini Titan, Saturn 1B, Saturn 5 and Space Shuttle (United States); Shenzou (China).

This gives the clue to a key difference between aircraft and rockets: size, and related to this, 'Orders of Magnitude'. Aircrafts' size focuses on people; rockets' size focuses on function. Let's flag up a couple of simple examples. The full-size Saturn 5 moon rocket was >100m (~300') long, and as wide as a dual carriageway! A real Sako anti-hail rocket, designed to spray potassium iodide into freezing clouds, is <30cm (~12 inches..) long. In recent times, your author has judged a 1:100 scale, 1 metre (39") long, Saturn 5 and a 1:1 scale Sako in the same World Cup hall.

Aircraft – without exception – are designed to be used again and again, with maintainability built in, often for decades rather than years! Rockets are generally boosted once, before digging their own grave or splashing down! OK, the Space Shuttle was reusable, with the orbiter and solid rocket boosters being recovered…but the main fuel tank always needed to be replaced after each flight. This poses a challenge for the scale rocket modeller – it's pretty well impossible to see a specific rocket prototype that's actually flown. Drawings and images in books and journals are fine and where we all start, but that rocket in the museum might not be exactly like those that boosted. When modelling full-size aircraft, this

Stuart's Vertikal parachutes back safely. Shown are the main body, nose section and instrument capsule.

Continued on page 3

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Continued from page 2

Comparing Scale: Rockets vs. Airplanes

side of life is much, much, easier.

Construction

Most scale model rockets are built in traditional ways, using 'traditional' materials. These include cardboard tubes, balsa & plywood, clear & coloured dopes, plus contemporary resins, extruded plastics and composite materials. Space Modelling is very good at layering traditional and contemporary methodologies together. Finishing techniques frequently involve traditional doping/filling/sanding, with the objective of bringing the array of construction materials to the same state, prior to the application of finishing coats – normally using aerosol sprays - and detailing. Lettering/numbers can be designed and handed over to specialists, who will prepare accurate decal sheets.

Apogee Components and other kit manufacturers have routinely featured a number of scale models in their ranges and this is where most will start. The biggest advantage of taking this route is that successful flights are normally assured, provided the instructions are followed and the model is built properly.

Applying the decals to the Apogee Saturn 1B.

In contrast, in Eastern Europe a number of prototypes have been kitted, using contemporary composite materials. The Serbian Ultra manufacturer produces a number of sounding rockets – mainly for FAI class S5-Scale Altitude – and it's possible to get a quote on a 1:50 scale Saturn 1B!

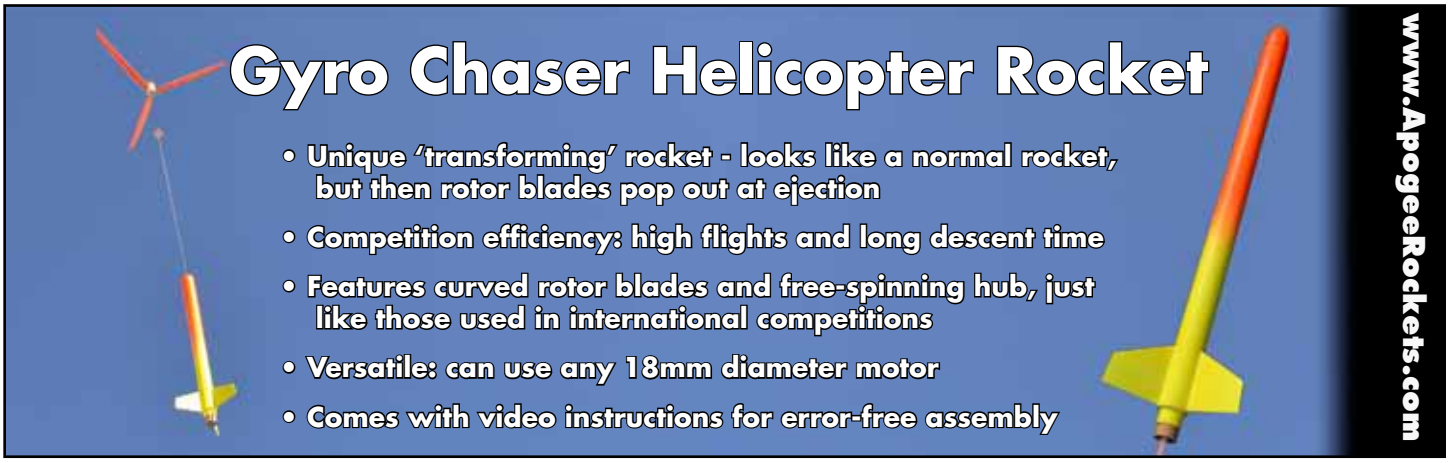
Prototype selection

This whets the appetite for more and where should the prospective scale enthusiast go from here?!? Your scribe will always recommend choosing a single-stage Sounding Rocket for a first scratch-build, rather than the Space Shuttle. Why?!? Sounding rockets were conceived to boost high into the stratosphere and beyond, to collect meteorological data and transmit this back to the ground, and these normally resemble basic Estes' kits. They tend to be fairly simple and will normally boost/recover perfectly. Examples include BAJ Skua – your scribe's is 1986 vintage! – Viking, Terrapin, ASP and others. Unfamiliar names!?! Then you'll need to do some…

Research! + how big and how high

Scratch building involves obtaining information – Scale Data – on the prototype to be modelled. The sources are wide ranging, and basic needs include how long, what diameter(s), fin size(s), nosecone shape and colour details. How big should it be? The major body tube diameter chosen for the model, determines the Scale of the rocket. Estes has body tube diameters ranging from 13mm (~0.5") to ~100mm (4"), with nosecones – in plastic and balsa – to match, many of which can be adapted for scale modelling. Centreing rings, to locate smaller tubes concentrically

Continued on page 4



Continued from page 3

Comparing Scale: Rockets vs. Airplanes

Research: magazines, books, drawings, plus decals.

within larger are also stocked and very useful.

How high will it go? At this stage, rocket motor needs should be determined, in parallel with the recovery system required. Motors come in a very wide range of Specific Impulse; Time-Thrust curves, Ignition spikes, Thrust-Delay combinations, … and at this stage it's getting a bit technical, so we'll stop and suggest a read of books by a guy with a name like mine! *Model Rocketry-Space Modelling 2nd edition* ~ Traplet Publications ISBN 978-1-907712-00-5

The Model Rocketry Handbook C21st edition ~ Special Interest Model Books ISBN 1-85486-229-4

This is important, because the building and flying of advanced scale model rockets is no easier than scale model aircraft, with the prospect of hundreds of hours of work being splatted. Fin Area and Nosecone Shape are big players in the stability equation and many full-size rockets have little fin area – or none at all. Centre of Gravity (CG), Centre of Pressure (CP), CG-CP relationships, CP migration, and instability et. al. are all very important and related to a rocket's shape and fin area.

FAI Contest Events: S7-Scale and S5-Scale Altitude

When the world comes together to fly scale models, watch out for FIREWORKS! Not literally, but the standard is very high indeed and yes, there are two competition classes listed, so what's it all about?

S7-Scale: The category of S7 is the equivalent of FAI generic F4-Scale for model aircraft. It involves the researching of a specific prototype, modelling it down to the last rivet, documenting it and then putting in a qualification flight

Continued on page 5

Continued from page 4

Comparing Scale: Rockets vs. Airplanes

The S7 contest features highly detailed scale rockets, like this Soyuz model built by Dimitar Vachkov of Bulgaria. Note the ignition system for the motors. Inset: Mikhail Noritsin's (Russia) Soyuz sheds its boosters and recovers them under streamers, lots of streamers!

packed with Special Effects (SFX). Models are statically judged - Technical Data, Degree of Difficulty, Scale Adherence, Workmanship, plus Flight Characteristics + SFX layered in later, to define the final rankings. Flight points are enhanced by multi-staging, using lots of rocket motors, space capsule deployment, launch smoke, plus lots of parachutes and streamers in the recovery phase.

Faults…too few prototypes are modelled and there are far too many Arianes and Saturn 1Bs in most entries. Recent FAI Sporting Code rules' changes, including not scoring the Scale Data packs and having an 'Originality' bonus for prototypes that are unique in the judging hall, have gone some way to increasing both the diversity and numbers in a typical World Cup entry. S7-Scale had become too academic and much too restricted in content. Innovative changes were needed, resulting in this iconic World Cup class becoming much more popular in 2014.

S5-Scale Altitude: "How high do they go?"

Every model rocketry enthusiast has heard this question…dozens of times! Re-read the section on S7-Scale, add minimum model dimensional and propellant Specific Impulse limits, plus an electronic Altimeter (eAltimeter) and we've the basis for an attractive performance event. Normally, the event is best flown with 2-staged sounding rockets, eg. WAC Bumper, Taurus Tomahawk, Nike Apache/Cajun/ASP etc. Diversity is limited, just like S7-Scale, but spectacular and scored by adding the scale Static Score to the eAltimeter

This Wac-Bumper model is typical for the S5 contest event.

Continued from page 5

Comparing Scale: Rockets vs. Airplanes

reading in Metres.

Both S7-Scale and S5-Scale Altitude are flown by Seniors and Juniors. In the latter, juniors fly smaller models with lower Specific Impulse motors.

History - back to the future..

Scale model rocketry has contributed significantly to

This is what the scale hall looks like at a Major Champs, this one's 2013's 14th European Space Modelling Championships, in Bulgaria.

Aerospace history. So much of the information relating to former-Communist rockets was top secret and would have remained so – and lost - but for the commitment of model rocketry devotees. Most notable of these is Vladimir Minakov, who has documented almost all former-Soviet rockets, including V-5-B Vertikal, Interkosmos, Vostok,and Soyuz generics. Without his priceless work, so much history would have been lost forever. Similar researches have taken place in the USA and Western Europe, with much of this accumulated in: *Rockets of the World* ~ by Peter Alway, Saturn Press ISBN 0-9627876-5-5 (Available at www.nar.org/NARTS/)

Round up..

Scale model rocketry is very satisfying, but like modelling scale aircraft, the enthusiast needs to determine priorities. There's no point expending 1000 hours on a super-scale model to fly at the local field, just keep it simple, safe and strong. As one moves up the ladder, more commitment is needed, and much more scale data needs sourcing. For the World Cup and Major Championships, the Modeller, the Model and the documentation need to be MAGIC!

Spectators always say that scale rockets zoom away much too rapidly to be realistic and most of the time, that's

Continued on page 7

Continued from page 6

Comparing Scale: Rockets vs. Airplanes

a fair observation. Vital though, is that the rocket must be flying when it reaches the top of the launch rod, or aerodynamic instability and a crash is inevitable. However, keeping a scale model light and choosing the propellants – model rocket motors – intelligently, can result in realistic, slow and smoky launches.

These BAJ Skuas (in 1:5 and 1:3 scale) were built by Stuart Lodge (UK) and fly beautifully.

Your scribe's 1:3 scale BAJ Skua streaks away quickly – just like the real sounding rocket – when boosted by an Estes D12-5 motor, leaving a super smoke trail. His 1:25 scale V-5-V Vertikal (shown on page 2) needs to be much slower and using a D12-3 motor in a heavier model produces a realistic smoky launch and a slow boost away to a modest altitude – where the judges can see the SFX clearly. While not the best S7-Scale model on the planet, his Vertikal is the slowest and has nailed 20 World Cup podiums, plus the overall Bronze medal in 2006. Realistic flight characteristics need to be sorted out at the design stage.

Model Aircraft and Model Rockets have much in common, but a few focal differences. One fundamental - orders of magnitude again - there are lots more full-size aircraft available to model than rockets.

About the Author

Stuart Lodge is a famous name in rocketry in the United Kingdom and also among competition modelers in Europe. He's written several rocketry books, including *"Model Rocketry," "The Model Rocket Handbook"* and *"Stu's Space... The Gospel According to Stuart Lodge. A Cornucopia of Space Modelling & Model Rocketry: The World Game."* He can be contacted at: stuart.lodge1@ntlworld.com

Pavel Brony (Czechoslovakia) pushes the button and his super Ariane 44LP lifts off at the 2008 Ljublana Cup. Super flying site.

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