ASTROBOOST: USING JWST SCIENCE TO SURVEY PUBLIC ENGAGEMENT ACTIVITY, INSPIRE AMATEUR ASTRONOMERS AND SHOWCASE UK INVOLVEMENT TO THE PUBLIC

Final report March 2019

The Royal Astronomical Society (RAS)'s AstroBoost project ran from March 2018 to March 2019. It was funded by a STFC Spark Award of £15,000 (ref. ST/R005826/1). The Primary Applicant was Dr Sheila Kanani (RAS Education Outreach and Diversity Officer).

The project had two main strands. Firstly, a survey of Astronomy Society (AS) public engagement activities in the south of England. Secondly, production of resource kits to support three partner societies in delivering public engagement activities related to the James Webb Space Telescope (Webb).

The three aims of the project were:

(i) to survey public engagement activity by astronomy societies in the SAGAS region

(ii) to develop a new mechanism to support astronomy societies in delivery of high quality public engagement activities

(iii) to showcase James Webb Space Telescope (JWST) science to the public, highlighting the UK involvement.

AstroBoost was run in partnership with Guildford Astronomical Society (GAS), Hampshire Astronomy Group (HAG), Newbury Astronomical Society (NAS) and the STFC's UK James Webb Space Telescope campaign (Webb Campaign). The project was conceived, managed and delivered by Dr Jenny Shipway (JS).

Project report summary:

AstroBoost has quantified the perhaps under-valued contribution of southern-region astronomy societies to informal education, and investigated how this work might best be supported. Almost all societies have public engagement embedded in their work with about two thirds seeking to increase their audiences.

The project successfully demonstrated influence of communicated topics and improved practice via delivery of requested resources and training to society members. As a result, Webb science has been communicated to a large number of people who otherwise may not have been engaged. Impact is expected to extend significantly into the future through continued use of skills and resources.

The project met the large majority of its aims and objectives. It completed on deadline and slightly under budget. The partner societies engaged a total audience of 909 within the delivery period (target 3000) and expect to reach target through increased use of resources as part of a strong project legacy. Future projects should allow extended time periods for societies to implement new practice.

ASTROBOOST

Contents

1 Project overview and plan

1.1 Background

There are 217 society members of the national Federation of Astronomy Societies (FAS) and 21 member societies of the Southern Area Group of Astronomy Societies (SAGAS). These societies bring together amateur astronomers in a social setting and usually run programmes of talks for members. Some groups also build telescopes, manage observatories, and/or conduct research.

In addition to their core activities, many societies carry out public engagement, by supporting other organisations' events and/or running their own.

To the knowledge of the Project Team (including discussion with representatives of FAS and SAGAS) there had previously been no regional/national survey of activities. However, the following was thought to be the case:

- Activities most typically include star parties, talks (including for schools, scouting movement and adult groups), visual displays, and use of telescopes. Less typical activities include observatory tours, use of handling objects and delivery of workshop activities.
- Typical audiences include families, general public, schools, scouting/guiding groups, and adult groups (eg U3A, Rotary).
- Events are typically local, and low-cost or free entry. Note that these factors are known to aid engagement of audiences with lower Science Capital who are less likely to eg visit science centres. "Sidewalk astronomy", where telescopes are brought to a public space to engage passers-by, is of particular interest in this respect.
- There are very few reported cases of societies seeking funding to support public engagement. Fundraising is generally focussed on purchase of observatories/telescopes.
- Not all societies practice public engagement. Some do, but without considering themselves as science communicators. Societies vary in the level and expertise of their activities, these often relying on a small core of keen volunteers with limited access to society funds.
- Some societies have links to specific science communication organisations, but societies are not embedded in the wider science communication ecosystem. A rare example of a link is a 2011 science communication conference organised by Newbury Astronomical Society (Project Partner), with speakers including Dr Jenny Shipway (AstroBoost Project Manager, at that time representing Winchester Science Centre).

1.2 Project aims

There were three project aims:

1. Survey public engagement activity by astronomy societies in SAGAS region.
2. Develop a new mechanism to support astronomy societies in delivery of high-quality public engagement activities
3. Showcase James Webb Space Telescope (Webb) science to the public, highlighting the UK involvement.

1.3 Project objectives:

The project objectives were as follow:

1. Survey society activity across the SAGAS region to produce a brief report of current public engagement, including activity levels, stated motivations and barriers. (Feb-Apr 2018.)
2. Discuss the survey results with the three astronomy society partners, and learn from their experience, to produce a list of general needs and requirements for astronomy society resource development. (Apr 2018.)
3. Create and distribute three sets of public engagement resources, including accurate Webb themes, appropriate to the participating societies' needs. These not to include general astronomical equipment. (May-July 2018.)
4. Create and deliver full-day cross-society training to at least three members from each participating society. To include use of resources, unconscious bias, gender awareness and child protection. (July 2018.)
5. Each participating society to deliver activities using the new resources at a minimum 2 events, collectively engaging an audience of at least 3000 during this period. (Aug 2018 – Jan 2019.)
6. Evaluation to be carried out by societies, with at least one event by each partner to be evaluated in more depth by the Project Manager. (Aug 2018 – Jan 2019.)
7. After each society has completed two events, at least one person from each society to meet together to discuss project outcomes. (Feb 2019.)
8. Production of an end of project report. (Feb 2019.)
9. Project report made available for download from RAS website (assuming new website design allows), and from the Webb Campaign website. The latter also to include access to assets that may be shared. (Feb 2019.)
10. Project report sent to SAGAS and FAS, and the project briefly summarised on the PSCI-COMM, BIG-chat, Dome-L and BAP email lists, with a link to access the full report. (Feb 2019.)
11. Session proposals submitted to present the project at the 2019 SAGAS Convention (Summer 2019) and British Association of Planetaria 2019 conference (Sept 2019).

1.4 Project budget

Funds Awarded

	Authorised FEC (£)			RC Contribution (£)			
	net	Indexation	Total	net	Indexation	Total	% FEC
Total - Staff	9,420	0	9,420	9,420	0	9,420	100
Total - T&S	773	0	773	773	0	773	100
Total - Other Costs	4,807	0	4,807	4,807	0	4,807	100
Total Value of Award	**15,000**	**0**	**15,000**	**15,000**	**0**	**15,000**	

Cost of Access to Facilities 0
(Funds not awarded to Grant Holding Organisation)

2 Project outcomes: overview

2.1 Aims and objectives

In general, project aims and objectives were met, with the following significant provisos:

1. The audience reached by the astronomy societies within the timeframe of the project (970) was lower than project plan (3000). This was due to a number of factors as discussed in section 5.1. All societies plan to increase use of the resources in future, so that the audience target is expected to be met over a longer time period.
2. Due to the timing of the funding confirmation, the project began one month later than originally planned, and so some deadlines were moved forward within the project timeframe.
3. Survey deadlines were extended (April 2018 to December 2018) in order to secure 100% responses. Getting high quality data was prioritised over meeting this arbitrary deadline.
4. No observation visit was carried out for HAG due to cancellation of the planned event. NAS was observed twice and so the original target of at least three visits was still met.

The project surpassed expectations in that:

1. A list of resources that might be provided in future by FAS was created.
2. Participation by AS members at the training day was higher than plan (12 vs 9 attendees). This was made possible by previous underspend due to AS partners not claiming travel expenses.

2.2 Budget vs actual Costs

The AstroBoost project ran just under budget. However, it should be noted that this was despite overspend of JS's time, especially during the resource development phase. This additional time was not invoiced.

The survey phase did require its travel budget, nor did AS members claim travel expenses at any time. These savings allowed more places to be made available at the training day.

The budget was as follows:

- Survey – 2.6 days JS; £55 travel
- Webb Campaign liaison – 1 day JS
- Resource planning and development – 13.6 days JS; £315 focus group expense; £4,500 resources
- Resources delivery and training – 4 days JS; £399 training day expenses
- Evaluation by observation of events – 1.7 days JS; £55 expenses
- Summative evaluation – 2.5 days JS; £246 focus group expenses
- Final report / dissemination – 2.5 days JS

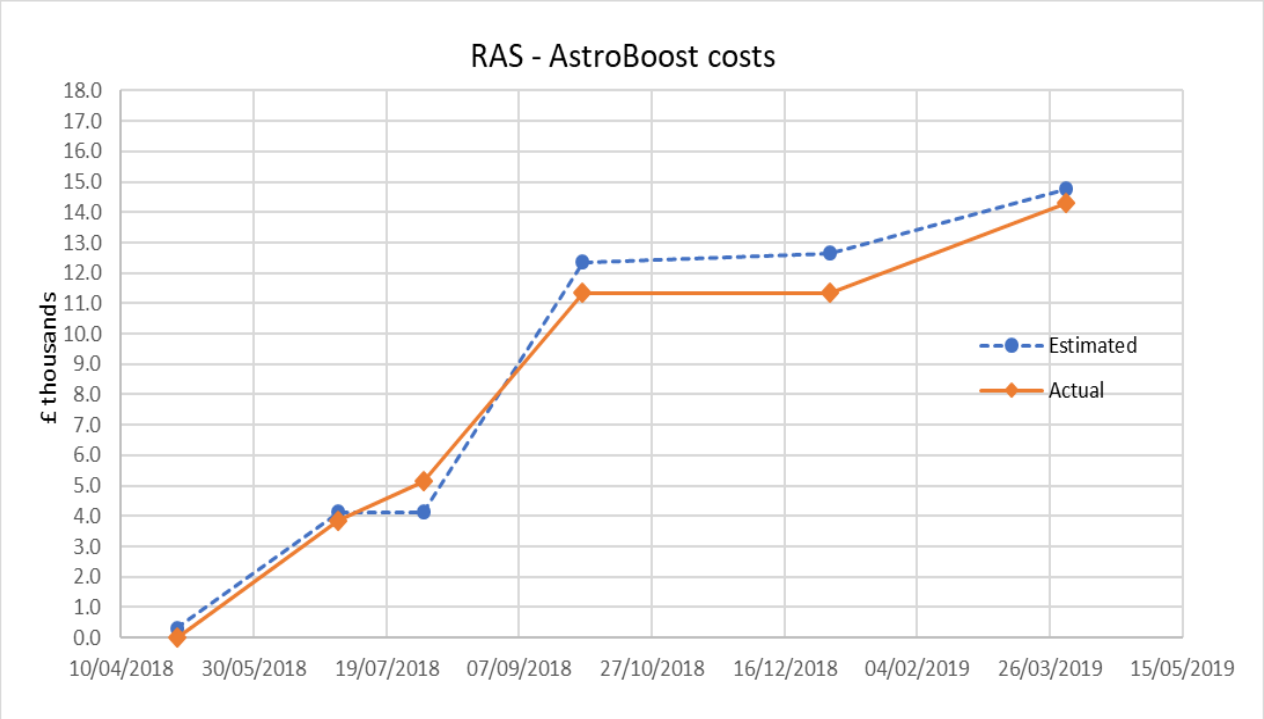


Figure 1: expenditure budget vs actuals

In-kind support:

- AS members: 12x half-days (focus groups), 14x full days (training day) and liaison time.
- Communication resources from the Webb Campaign, Dave Hills and Steve Wilkins.
- Resource development time, guidance and general support from the Webb Campaign.
- Resource development time from Dave Hill, Steve Wilkins and Steve Shipway.

Also:

- STFC covering expenses for JS attendance at Webb Campaign public engagement meeting (£257.70)

3 Survey of AS activity across the South

Relating to project Aim 1 and Objective 1:

Obj. 1. Survey society activity across the SAGAS region to produce a brief report of current public engagement, including activity levels, stated motivations and barriers. (Feb-Apr 2018.)

A full survey report is available for download from https://www.ras.ac.uk and https://www.jwst.org.uk/articles/astroboost/. To avoid large-scale replication of material, the below focusses more on the implementation and general outcomes, with only brief discussion of the survey findings.

3.1 Survey region

The survey was originally intended to cover the same region used by the Southern Area Group of Astronomical Societies (SAGAS). However, as this region is not precisely defined, the survey area was amended to include the full counties of **Dorset, Hampshire, Surrey, Sussex and the Isle of Wight**, while excluding Kent.

The SAGAS region is informally considered to extend up to the M4 motorway, and so also includes **part of Berkshire**. The only two members of SAGAS based in Berkshire are project partner Newbury Astronomical Society, and Reading Astronomical Society. Both are included in the survey.

In all, 30 Astronomy Societies (AS) were identified within this region (locations shown in figure 2; full list provided in Appendix 1). Of these societies, 19 were members of SAGAS. Many of the societies are also members of the national Federation of Astronomy Societies (FAS).

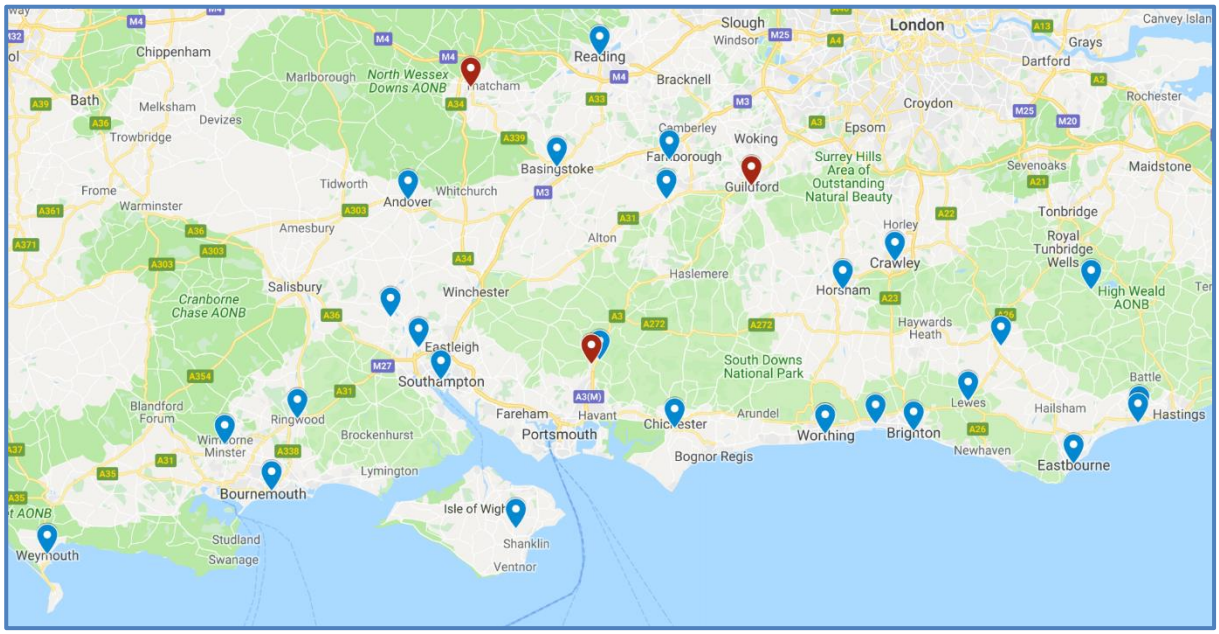


Figure 2: locations of AS across Dorset, Hampshire, Sussex and Isle of Wight, also Newbury AS and Reading AS. Red markers denote project partners. Map created in Google Maps.

3.2 Survey data collection

The survey was administered using Google Forms, which offers a simple and free platform. One society required the form to be printed, to be completed by hand and returnd by post.

The survey design can be seen in Appendix 2. Data were exported from Google Forms into an Excel spreadsheet for analysis.

Societies were contacted via email where a contact address was available on the society website. Other methods included via website forms, via Facebook, Twitter, telephone and personal contact.

A brief overview of the AstroBoost project was also given, and an offer of any support as required to enable participation in the survey. It was made clear that the results would be published, and that data could be anonymised on request.

The majority of societies (22 of 30) responded within one month of the initial request. Of the remainder, most (5 of 8) responded within ten weeks. It took in total 8 months to secure all 30 responses.

Identified reasons for delayed responses included:

- Spam filter eating an automated reply providing a change of email address for the AS.
- Uncertainty about what information was required. In response, the form was resdesigned so that all fields were visible immediately (previously it was designed only to display detailed questions about public engagement if some was identified to have taken place).
- Requirements to discuss particpation at the next committee meeting.
- Late request for participation for a society that was only 'discovered' late in process.
- Unable to access online form. The society requested an exported version, which was printed, completed by hand and returned by post.
- Misconception that the request was with regard to participation in a project, as opposed to being a request for completion of a brief survey.

To avoid over-running the budgeted time, no societies were visited during the survey.

3.2 Survey design

The survey was designed as shown in Appendix 2, with SAGAS and FAS contacted for comments before this was sent out (no amendments were requested).

The survey was kept short to encourage participation, and language was designed to be clear to those without experience in public engagement.

3.3 Survey outcomes

The 11-page survey report was published in March 2019. It is available by free download from https://www.ras.org.uk or https://www.jwst.org.uk/articles/astroboost/, or by request from Dr Sheila Kanini at skanani@ras.org.

Survey findings will be presented at the British Astronomical Association Weekend in April 2019 and the British Association of Planetaria conference in September 2019 (both confirmed).

Key findings:

- Most (90%) societies consider outreach an important part of their society's activities. Most (90%) had been active in some form of public engagement within the previous year.
- The 27 active societies had together reached an estimated 19,530 people over the previous year. Most societies (63%) aspire to increase their audiences.
- The most common motivation was enjoyment of sharing the love of astronomy. Education and recruitment of members was also important (although the latter perhaps rarely achieved).
- Societies ranged from 10 to 350 members with a median of 55. Availability of willing and capable members was the primary barrier to increasing public engagement activity. Most activity was due to a small core of members, with additional members helping on occasion.
- Societies reached a broad range of audiences. The most frequent audiences were 'general public' and groups of children aged 5-11yr.
- Societies carried out a broad range of activities - mostly talks, use of telescopes at night, and naked-eye stargazing. Formal activities such as courses and workshops were less-commonly offered.

4 Webb resources: development and training

Relating to project Aims 2-3 and Objectives 2-4:

Obj. 2: Discuss the survey results with the three astronomy society partners, and learn from their experience, to produce a list of general needs and requirements for astronomy society resource development. (Apr 2018.)

Obj. 3: Create and distribute three sets of public engagement resources, including accurate Webb themes, appropriate to the participating societies' needs. These not to include general astronomical equipment. (May-July 2018.)

Obj. 4: Create and deliver full-day cross-society training to at least three members from each participating society. To include use of resources, unconscious bias, gender awareness and child protection. (July 2018.)

4.1 Formative focus group meeting, April 2018

A formative focus group was held on 20 April 2018 to achieve objective 2., and to inform objective 3.

At least one member from each partner AS was required to attend. This meeting featured delicious pastries but ran under budget due to self-catering and unclaimed travel expenses. The venue was provided at no cost by JS.

Attendees:

- Jenny Shipway (JS), AstroBoost Project Manager
- Alastair Bruce from the UK Webb campaign (Royal Edinburgh Observatory, STFC)
- Nic Fleet & Steve Knight from Newbury Astronomical Society (NAS)
- David Harris & Graham Bryant (SAGAS) from Hampshire Astronomical Group (HAG)
- Steve Piatkowski from Guildford Astronomical Society (GAS)
- Paul Daniels (RAS, FAS)

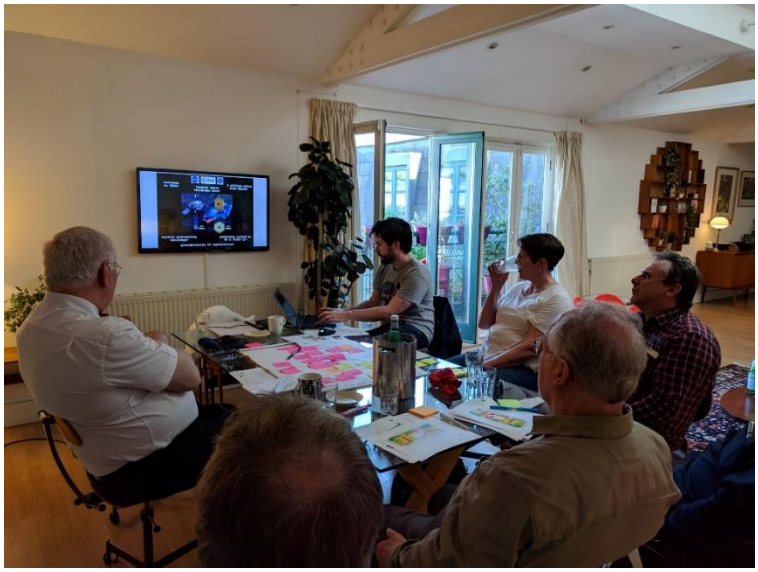


Figure 3: Formative focus group meeting, Winchester, April 2018, photo by JS

4.1.1 General list of requirements for AS public engagement (project objective 2)

The survey findings to date (19/30 responses) were discussed.

All partner societies are experienced in public engagement. The discussion resulted in the following list of resources recommended to support astronomy societies with less experience in this area:

Suggested resources to support astronomy societies with less experience in public engagement:
Quizzes (pre-printed) for public and children
Posters for display stands
Branding assistance
Bringing groups together to achieve 'critical mass' – running joint events, sharing resources
Insurance – mitigating cost of this [note: could FAS arrange something through an insurer?]
Marketing assistance
Resources to help deal with anti-science (ie 'bullshit').
Up to date ppt slides about what is happening in space science today
Safety training
Laminator/pockets, to help displays look smart/professional
Display boards
PowerPoint presentations aimed at specific audiences (eg for scouting group badges)
Pop-up banners as set dressing
Science communication training day (link with STEM Ambassador scheme?), especially for new people.
Arrange for less-experienced societies to shadow more confident groups at events.
Arrange cross-society stands at hosted events.
Anything to encourage non-active members to get involved, especially where confidence is the main barrier.

Some items that were discussed were considered of use but more appropriate for provision by FAS:

Suggest resources that might be provided by FAS:
Example/accredited policy documents (eg child protection, solar safety)
Overviews of 'how to organise an event' including things people might otherwise miss and including guidance (eg insurance, risk assessment, working with partners)
Specimen 'contract' for use with external (hosting) organisations, to cover liability and similar issues.
Legal checks of specimen contracts etc to ensure these are correctly developed.
Evaluation training / collection of results
Encouraging junior astronomy groups (6-14yr) to address aging demographic and encourage younger members who are more likely to be active in outreach.

4.1.2 Guidance for development of AstroBoost partner society resources

The project was fixed in that the resources should relate to the James Webb Space Telescope (especially UK involvement in this project), and be of use to all three partner societies. The following points were agreed:

- Webb is welcomed as a theme, with no problems linking this as a topic.
- Audience flexibility is key. Target audiences include (i) families with children aged up to 14yr, and (ii) cubs/brownies (8-11yr) and (iii) scouts/guides (11-14yr).
- Activities will always be human-led, and do not need to be able to be left unattended.
- All groups have capacity to deliver activities in light or dark conditions, with no preference.
- Posters are welcome – larger is preferred to smaller.
- Take-away objects are good, even if very cheap/simple. Can also be used as quiz prizes.
- Activity resources should include information about how to set up and deliver these, risk assessment, background information and so on, to aid training within the AS.
- A set of demonstrations which could be carried out individually OR strung together in a described way to create a complete workshop for scouting groups would be very welcome.
- It is possible societies may be able to contribute funds to make it possible to buy items in bulk where this would reduce costs.
- Topics include the structure of the telescope, its location, wavelengths of light, objects visible to small telescopes, and what the telescope is expected to achieve.
- The Webb Campaign welcome discussion of the process of development including delays, budget over-runs, risk of launch – these should not be glossed over.
- Some guidance about how to develop additional activities / those not carried forward (eg how to use mobile phone to collect data on doppler pitch shifts) would be welcomed.

Alastair Bruce identified additional resources that might be provided by the Webb Campaign. He also indicated where they may be able to support development through their expertise or by facilitating networking with other organisations.

Specific ideas for activities / props / resources were also discussed and referred to in development of the resources.

4.1 Development of resources

No August delivery/training date was suitable for all parties, and 16 September was identified as the earliest possible date. The deadline for completion of resources was therefore pushed back to this date.

Obj. 5: Create and distribute three sets of public engagement resources, including accurate Webb themes, appropriate to the participating societies' needs. These not to include general astronomical equipment. (May-July 2018.)

4.1.1 Final planning of resources

Following guidance from the focus group, a proposed list of resources, approximately costed, was created and disseminated to the project partners. The societies were asked to comment on their preferred prioritisation of different elements, but little feedback was received.

One of the societies suggested sharing more-expensive items between the groups, but this idea was not supported by every group due to organisational complexity, and so this idea was not taken forward.

AS members were given the option of supporting development of resources to help stretch the budget further. Items were highlighted where this would be helpful, but this was not taken up in practice.

4.1.1 Procurement / development process

A full list of provided resources can be found in Appendix 3. Items were procured largely from Amazon to minimise the time spent in this process. For administrative simplicity, payment was made by JS who then claimed back the expense from RAS.

In addition to project partners and those acknowledged below, there were helpful discussions with Jaclyn Bell of the Association of Science and Discovery Centres (ASDC) "Destination Space" project and members of the British Interactive Group at their annual meeting (July 2018), especially Neil Monteiro.

The original intention had been to purchase a small number of more-expensive resources 'off the shelf'. However, it became apparent that (i) many demos were required to build an entire show, and (ii) there were few appropriate 'off the shelf' solutions available.

The large number of items procured resulted in a significant time over-run for this section of the project, that should serve a cautionary warning to those planning similar projects (taking 15 days vs the planned 7 days). However this over-run did not affect the project budget.

There were delays by the supplier in delivery of two of four 3D-printed models. There were also delays in delivery of pin badges and of two of three IR transmission devices. These materials were distributed to societies by 30 November 2018.

4.1.1 Resource kits – what did we get?

Resources were provided in weather-proof boxes for storage/transport, with written materials organised within folders. Printed materials were also provided on a USB memory stick.

<u>Resources included:</u>

- Flexible, demo-led show for ages 8-12yr, communicating what infrared is, how it differs from / is similar to normal light, and how this informs the design/capabilities of the Webb telescope.

- Additional demos that could be done outside the show.
- Instruction sheets, information sheets and pro-forma risk assessments for all the above.
- Pull-up banner (designed by Steve Wilkins, Univesity of Sussex / STFC).
- Webb pin-badges for AS members to wear during activities (donated by Steve Wilkins).
- Evaluation materials, including printed questionnaires, pens and a returns box.
- USB memory stick containing materials for resources as listed above and also:
    - Copies of receipts, to allow identification of suppliers/cost for future purchases.
    - The Destination Space 2 manual (includes background on Webb)
    - Flir-C2 camera manual
    - Powerpoint presentation as used on the training day
    - "Improving Gender Bias" report (Institue of Physics, March 2017)

Highlight items included:

- Flir-C2 infrared camera (£1,332 for 3)
- High-quality 3D printed Webb telescopes (15cm, using NASA design, £720 for 4*)
- Bagged kits for construction of Lego Webb telescopes (design by William Taylor, pieces procured by Steve Shipway, £512.36 plus printing for 300 kits plus spare parts)
- 'Left-over' bolts from MIRI construction (provided by Webb Campaign)
- Replica pupil masks from MIRI (genuine replica minus powder coating, £378.90 for 125**)
- IR transmission devices (~£90 in materials for 3, developed/built/donated by Dave Hills)
- Scale model mirror, total size equal to a single Webb segment (constructed by Dave Hills)

* One held by RAS as a spare
** Minimum possible order size; shared with RAS, Webb Campaign and Steve Wilkins (STFC)

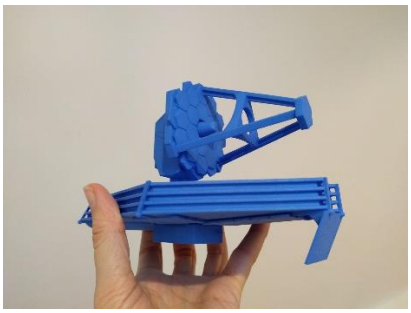
Dave Hills (a professional workshop coordinator) had supported events run by JS at Winchester Science Centre as a STEM Ambassador. He donated his time and materials in support of the project's aspirations to inspire children about STEM.

Steve Shipway is the brother of JS. He volunteered to procure the lego pieces and also designed the instruction sheet. He works in IT and donated his time in support of STEM education.

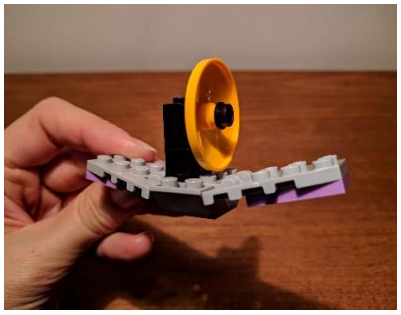
Thanks also to Birna Rørslett-NN/Nærfoto (www.ultravioletphotography.com) and Prof. Darryl Jones (Griffith University, Australia) for free licencing of photographs used in the demo/show presentation.

A full list of the provided resources can be found in Appendix 3.

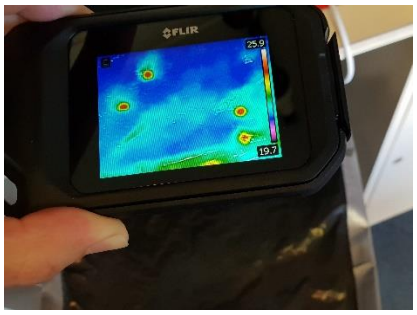
All project information sheets, Powerpoints, scripts and risk assessment pro-formas are available for free download from https://www.ras.org.uk or https://www.jwst.org.uk/articles/astroboost/ . Note that some of the images in the Powerpoint have restricted licences (details are given in the script document).



3D-printed Webb model



Lego Webb telescope, from kit



IR camera / print tray activity

Assembled mirror

Reflecting IR-transmitted music from Mylar

Figure 4: AstroBoost resources/activities. IR camera and gold mirror images by Alastair Bruce, others by JS.

4.2 Training day

Obj. 4: Create and deliver full-day cross-society training to at least three members from each participating society. To include use of resources, unconscious bias, gender awareness and child protection. (July 2018.)

The 17 September 2018 training was held from 9am – 5pm at Clanfield Observatory.

This venue was provided free of charge by Hampshire Astronomical Group, who also provided support in running the event. Attendees enjoyed a tour of the site, including the 24" Ritchey-Chrétien reflector.

The training day was attended by Alastair Bruce (Webb Campaign) and 12 members from partner societies (target nine). The additional spaces were possible due to savings on travel and catering expenses earlier in the project.

The training day included:

- Introduction to the AstroBoost project and brief look at survey results to date
- Talk with Q&A about Webb by Steve Wilkins (University of Sussex / STFC) – this was excellent!
- Run-through of the demo-led show
- Risk assessment overview and example
- Lunch buffet (provided by an external caterer, with additional drinks / snacks)
- Child and vulnerable person protection
- Gender bias in STEM (with evidence to show this is not explaind by innate preference)
- The Royal Society's Unconscious Bias video
- Free exploration of the kit; a chance to try things out and ask questions

- Evaluation requirements
- Distribution of resources to the societies

Figure 5: AstroBoost training day at Clanfield Observatory

5 Delivery of Webb activity resources

Relating to project Aims 2-3 and Objectives 5-7:

> Obj. 5: Each participating society to deliver activities using the new resources at a minimum 2 events, collectively engaging an audience of at least 3000 during this period. (Aug 2018 – Jan 2019.)
>
> Obj. 6: Evaluation to be carried out by societies, with at least one event by each partner to be evaluated in more depth by the Project Manager. (Aug 2018 – Jan 2019.)
>
> Obj 7: After each society has completed two events, at least one person from each society to meet together to discuss project outcomes. (Feb 2019.)

5.1 Overview

Delivery was largely carried out by 8 AS members, all but one of whom had attended the AstroBoost training. It is believed that additional members also used the activities without evaluation being carried out.

Together, the three societies used the activities at a total of 18 recorded events over the six months between September 2018 and March 2019, engaging a total audience of approximately 970 people.

Audience reach is significantly below target (3000) for reasons as discussed in section 5.5.3.1. However, with a strong expectation for significant legacy use the original target is expected to be met over a longer time period.

Audiences included schools, cubs, adult groups and the public, and participants were 57% adult and 16% 8-11yr. Contexts included demo-led shows, round-robin activities and drop-in stands. Venues ranged from the Excel Centre (New Scientist Live) to a small village hall.

More detail about these events and audiences is given in section 6.3.3 below.

5.2 Legacy use of activity resources

The activity resources remain with the societies, with one spare 3D printed telescope held at RAS in case of damage. At the time of writing, all resources are in good order.

All three partner societies strongly stated that they would not only continue to use the resources, but also increase their use of these through integration into other talks. These plans included:

- HAG have integrated the resources into their Astronomy for Beginners course.
- GAS will be using the resources at a careers fair promoting UK science.
- GAS intend to decouple the resources from Webb and integrate these into more general IR-astronomy content including links to UK science and engineering and women in engineering.
- GAS to include use of Powerpoint slides as a talking point for drop-in displays.
- NAS intend to continue focussing on Webb, using the launch delay to highlight the complexity of the project.
- Hands-on activities allow for a more-gentle entry to public engagement activity for AS members than the (more common) talks. There was discussion of how this might be used to encourage less-confident members to take part in future activities.

5.3 Evaluation: method

> Obj. 6: Evaluation to be carried out by societies, with at least one event by each partner to be evaluated in more depth by the Project Manager. (Aug 2018 – Jan 2019.)

Societies were provided with both A4-printed and soft-copy questionnaires as shown in Appendix 4. They also received a returns box suitable for single-folded A4.

Questionnaire versions included:

1. Delivery team – 8 returns
2. Demo-led show group leaders – 9 returns (3 events)
3. Demo-led show participants – 23 returns (2 events)
4. Other activity participants – 88 returns (6+ events)
5. Show/Event information sheets for completion by AS – 18 returns

It was not always possible that audiences should complete questionnaires due to the nature of the events, for instance where time was limited. Also it was noted that some AS members had not filled in evaluation forms due to personal preference, and so some data was missing.

One school submitted grouped participant data that had been collected by a teacher over one week after the event (sharing one form). This data has been excluded due to the different collection technique and likely impact on responses. However, individual teacher questionnaires from this school were accepted.

JS attended three events to observe use of activities and talk to participants. This included two events by NAS (one GCSE evening class, one KS2 school) and one event by GAS (Cubs pack). No HAG event was observed, as the planned event (31 January) was cancelled at short notice by the school. This unfortunately left no possible alternative date before project deadline.

5.4 Summative focus group meeting, 8 March 2019

> Obj 7: After each society has completed two events, at least one person from each society to meet together to discuss project outcomes. (Feb 2019.)

The final focus group was held slightly later than originally planned to allow time to complete collection of evaluation data and due to attendee availability. It was held in Winchester; venue provided at no cost by JS.

This focus group included two AS members each from NAS and GAS and one member from HAG. All attending AS members had personally delivered AstroBoost activities, and all but one (Julia Gaudelli) had been present at the formative focus group meeting.

Attendees:

- Jenny Shipway (JS), AstroBoost Project Manager
- Nic Fleet & Steve Knight from Newbury Astronomical Society (NAS)
- Graham Bryant (SAGAS) from Hampshire Astronomical Group (HAG)
- Steve Piatkowski from Guildford Astronomical Society (GAS)
- Julia Gaudelli from GAS (attending by Skype connection)

Focus group findings are interleaved with other evaluation data below.

5.5 Evaluation: results

5.5.1 Project management

In the final focus group, the attendees agreed that the project had proceeded as expected, with no unpleasant surprises and clear communication throughout. The AS groups felt they had been appropriately involved in helping direct the project with agreement that the Formative Focus Group had been vital in achieving this.

The AS members agreed that the project had been “no trouble” and that its benefits far outweighed the work they had contributed. The Webb launch delay was not considered to have been a significant problem.

Two useful points to inform future project planning were identified:

1. It takes significant time to train and set up for use of new resources, especially where there is a team sharing outreach activities and so each individual is less active than the society as a whole. For this reason, the window for delivery of the AstroBoost resources was tighter than had been anticipated.

2. It takes a long time to encourage AS members to consider use of new resources. All three partner societies had carried out further, in-house training. However, some members were only just starting to show interest by the project end date (this despite highlighting that use of resources was not prescriptive and they could be integrated into current activities rather than supplanting these). Some members stated they would have preferred training directly from the AstroBoost project. It was agreed that less confident members would benefit from seeing activities being delivered.

5.5.2 Suitability of developed resources

In the summative focus group, there was a discussion as to whether it had been the correct decision to focus on a flexible, demo-led show, as opposed to (eg) full-developed round-robin activities. The AS groups were unanimous in agreement that the show/demo format was better suited to their needs than other suggestions.

AS members who had delivered the activities were asked by questionnaire whether they would agree with the statements “The activities worked on a practical level”, “The activities were suitable for the audience” and “The activity information sheets were good”.

Number of AS members	**(Disagree) 1**	**2**	**3**	**4**	**(Agree) 5**

The activities worked on a practical level	0	0	2	3	3
The activities were suitable for the audience	0	0	0	6	2
The activity information sheets were good	0	1	0	3	4

During observation, a visiting regional Cub Leader explained that they had seen the AstroBoost talk/activities presented at a different cub pack and recommended them to this group.

It may be noted that the resources were not piloted with test audiences. As ever, this would have been useful and would have improved the final product. However, this would have come at significant cost and eaten away much of the resource budget. The plan had been to deliver resources that had been tested in other contexts rather than develop entirely novel activities, and in general this is what happened.

One issue that was not identified before delivery of the resources, was that of storage. The resources were delivered in sturdy, clear, waterproof boxes, which was appreciated by the AS groups. However, the total volume of these boxes was such that storage and transport was not trivial. It would have been better to plan for how to manage this issue in advance.

Powerpoint talk: what worked; what didn't work

Most AS groups offer Powerpoint talks, and this format is familiar to them. For this reason, having the talk was helpful in allowing the new content to fit into their normal practice. This format also requires fewer AS members to be present, as opposed to a purely activity-based practice.

The talk was designed to be flexible, eg with optional slides for higher-level concepts like wavelength. During the delivery period it was used for audiences including schools, uniformed groups and adult clubs (eg Rotary).

In observation all the societies had taken the opportunity to adapt the talk to their purposes, eg GAS had added a general astronomy section to the beginning to serve the needs of a Cub pack, and all groups had selected specific demonstrations as suited each audience.

In observation of the talk, comments from leaders included:

> Yr 5 teacher: [It was good] "Seeing stuff rather than just listening to someone talk" … "Should have been 30min talk but was 40min [ie 30min as planned would have been better]
>
> Yr 5 teacher: "A lot of information [too much]" … "Talking at them for a long time, they don't take much in"
>
> Akala Cub leader: [Ref the slide show images] "That's just wow"
>
> Cub leader: [Asked if it was age appropriate] "Perfect"

It was suggested by a number of participants and one group leader that it would be helpful to have a video of the deployment / mirror unfolding sequence. This was agreed by the evaluator on observation. The Webb Campaign have since recommended videos and the links for these have been shared with the AS groups and are given on an additional post-project advice document which will be disseminated with the project resources.

Demos/activities: what worked; what didn't work

Every activity was used in some way, at least one, by at least one society, excepting the water spray demonstration regarding which one AS member commented "We never got the chance to try out the water spray on a sunny day."

The activities used by the most AS members were the IR camera, IR-translucence/IR-opaque materials, and the spectroscopic glasses.

Figure 6: AstroBoost activities in use by Cub pack, photos by Guildford Astronomical Society

The strong hands-on element of the resources represented a significant change of practice for the astronomy groups, who were more accustomed to delivering talks and use of telescopes:

HAG: [Our use of hands-on activities was previously] “very, very limited”

NAS: “We had very little hands-on stuff”

GAS: [Of our previous activities] “some were quite old fashioned”

In observation discussions, many people mentioned the benefit of having hands-on activities:

Cubs leader: “Sometimes when people come they just talk”

Cubs parent helper: “Usually when people bring stuff it’s not so tactile” [giving example of a live hawk]

12-14yr questionnaire: “I enjoyed it because it wasn't a boring talk we were showed things”

The hands-on element was appreciated at adult events too:

Questionnaire: “Activities used to illustrate lectures about astronomy. Effective use by lecturer.”

Questionnaire: “Interactive activities make it much easier to understand!”

AS member: “The Rotary club liked the lego!”

Figure 7: adult AS members enjoying the mirror and lego assembly activities during training day. Photos Alastair Bruce.

Having multiple activities was observed to work well in a round-robin format. This was very successful with both yr5 school groups and with cubs, but required at least 3-4 people in the delivery team. It was important to ensure activities were of similar length. Comments about this format included:

> Cub leader: “Need to have someone with each activity to explain” ... “Fact that you have so many other things to do covered the fact we couldn’t go outside [to stargaze]”
>
> Cubs parent helper: “Can lose interest quickly so it’s good to move around“
>
> Cubs young leader: [Looked at activities but] “not a clue what to do” … “needs a bit more explaining”

The most popular activity with both participants and AS members was clearly (and not unexpectedly) the infrared camera. In observation discussions, GCSE students (teenager and adult) said they enjoyed learning about IR transparency in this way.

An AS member wrote:

> “Using the IR camera was the most popular activity - because it's visual, and relevant.” … “I let them use the IR camera by themselves. They investigated the supplied materials then went round the room to test other materials and making handprints etc.”

In observation, children were often allowed to have control over the camera and the chance to make novel investigations. In an observation of the print tray activity, the group of children had free rein to investigate their environment with the camera while the items were hidden.

The print tray game (identifying a pattern of hidden warm ball-bearings) and IR transmitter were also mentioned by AS members as particularly successful activities.

Three GCSE students mentioned the location of Webb as “the most interesting thing”. This may relate to the demonstration (eg “Orbit pattern – around (not directly at) the L2 point”). However, AS members reported that this activity proved difficult to deliver in practice due to tangling of the lines.

Other less successful activities mentioned by AS members were the bicycle pump (which failed to visibly heat up), colour filters (concept too difficult for younger children), and the replica parts (too fiddly and too difficult to explain). The replica parts had a significant cost and so this in particular was disappointing. AS groups have been asked to send any unwanted replica parts to the Webb Campaign to be used in other projects.

5.5.3 Reach

5.5.3.1 Numbers and demography

Figure 8: cubs assembling gold mirror. Photo Guildford Astronomical Society

Total audience reach was recorded as 970, over 18 events. This figure was lower than the target of 3000 for the following reasons:

1. Together, the partner societies engaged ~5250 people over a year period 2017-18. As the AstroBoost delivery period ran for six months and the project did not seek to increase audiences, the original estimate of 3000 was optimistic.
2. GAS note that some of their larger events fall outside the delivery period (eg a schools event in April, and Perseid event in August). They also reported lower than usual activity during the delivery period.
3. There was a delay in beginning delivery, while members became familiar with the resources and worked to integrate these into their practice. (See 5.5.1.)
4. Not all AS members took up the resources, with some only now starting to investigate how they might integrate these into their activities. One society commented, “Change is slow, you can’t force it”, and another “People are reticent, it takes time and encouragement”. One commented that there were members who did not want to carry out evaluation processes, and so were waiting for the project period to be over before taking the activities up. This meant that there were AS events where the resources were not used despite opportunity to do so. (See 5.5.1.)
5. Some AS members were reported to have used the activities but not collected evaluation data.

It should be noted that there is a very strong legacy element: all materials are still in good condition, and every partner society was confident that they would not only continue but also increase their use of these resources in future. They note that with time comes better experience of how this can best be achieved. Legacy use to include:

- HAG have integrated the resources into their Astronomy for Beginners course.
- GAS will be using the resources at a careers fair promoting UK science.
- GAS intend to decouple the resources from Webb and integrate these into more general IR-astronomy content including links to UK science and engineering and women in engineering.
- NAS intend to continue focussing on Webb, using the launch delay to highlight the complexity of the project.

The resources were designed to be flexible. As hoped, a variety of audiences were engaged (see figure 9).

The majority audience was members of the public attending events run either by the AS (eg HAG Open Evening) or by others (eg GAS at Rutherford Appleton Stargazing event). This resulted in over half the audience being 20yr+, over a third of whom were 65yr+. The next largest audience were ages 8-11yr, including pupils and Cubs. The clubs had mostly adult members.

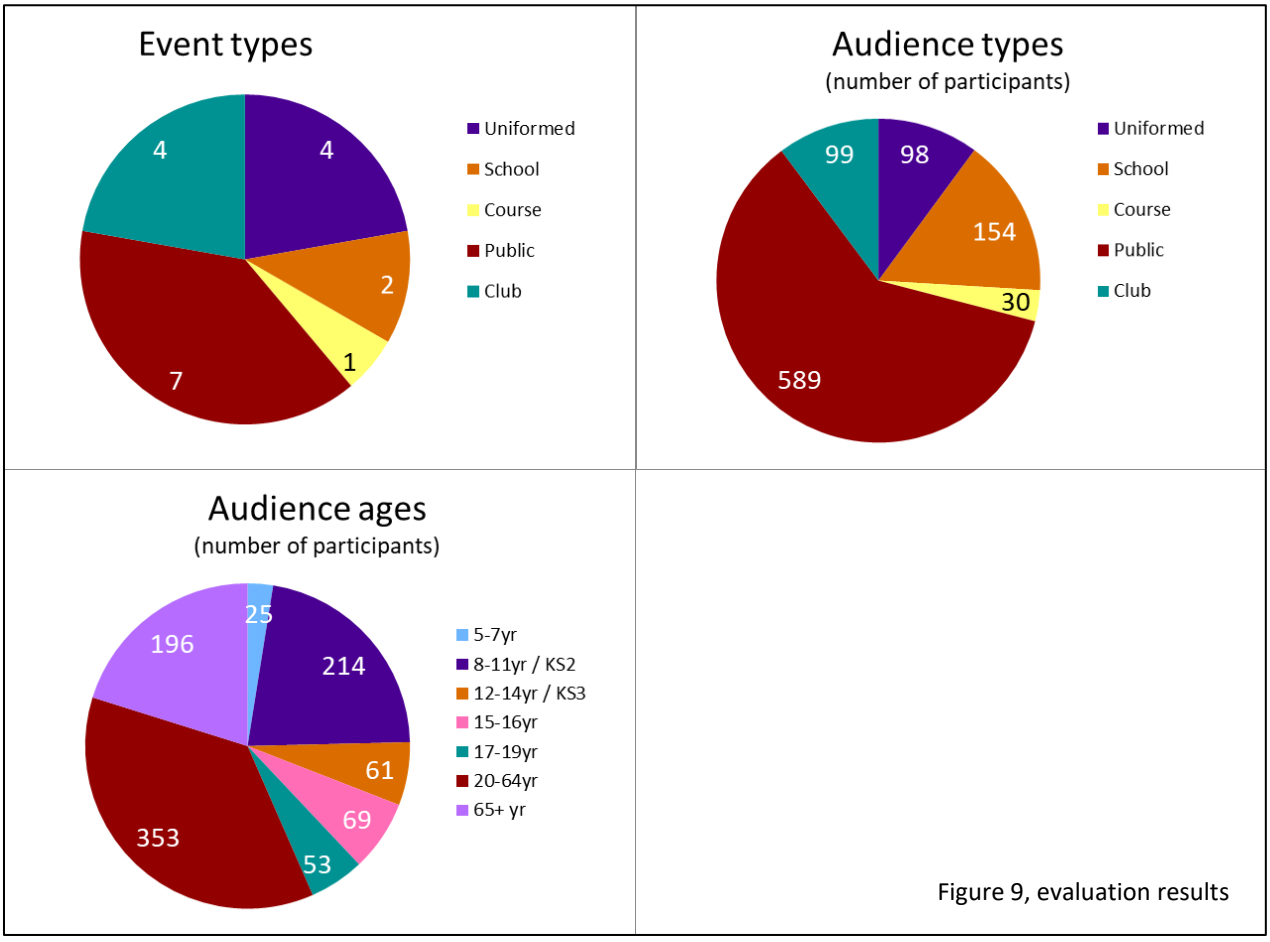


Figure 9, evaluation results

The audience gender balance was clearly skewed towards male (see figure 10). This may be due to a general gender skew in people seeking engagement with astronomy, as also seen in AS memberships. The delivery team was also skewed to male, although more gender-diverse that might be expected in an average AS group.

A small part of the gender skew was due to audiences including Cubs and Scouts (4 events) but not Brownies or Guides. NAS explained that their Brownie engagment did not use AstroBoost resources as the AS member delivering this had not (yet?) integrated any of the AstroBoost resources. GAS noted that the previous year they had a more balanced mix of Brownies and Cubs but this year it had been more skewed, perhaps just by chance.

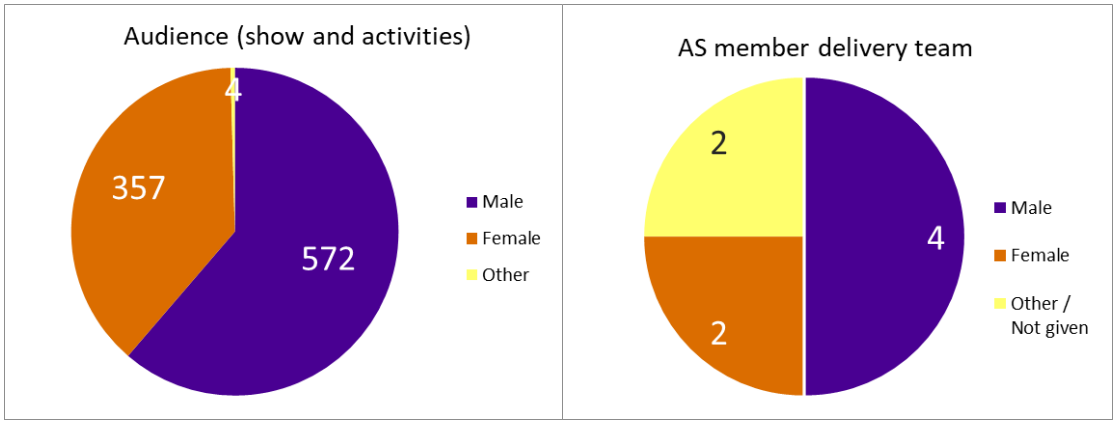


Figure 10: gender diversity of audience and delivery team

5.5.3.2 Audience Science Capital

To give an indication of prior science capital, respondents were asked "Had you heard of the Webb telescope before", "Had you done astronomy activities before" and "Does anyone in (or close to) your family have training, expertise or a job in science".

Only about half the participants said they had heard of the Webb telescope before.

Number (and %) of participants*	No	Very little	Yes
Had you heard of the Webb telescope before	55 (49%)	28 (25%)	29 (26%)
Had you done astronomy activities before	38 (34%)	38 (34%)	36 (32%)
Does anyone in (or close to) your family have training, expertise or a job in science?	42 (48%)	6 (7%)	40 (45%)

* Including cubs, pupils and general public but not group leaders

Number of group leaders** (shows only)	No	Very little	Yes
Had you heard of the Webb telescope before	7	2	0
Had you done astronomy activities before	2	2	1
Does anyone in (or close to) your family have training, expertise or a job in science?	7	2	0

** Including cub leaders and teachers, answering on their own behalf

They were also asked whether they would agree with the statement "I was already interested in astronomy or physics before today". Over one third (38%) of participants and 7 of 9 leaders answered 1-3 on the 5-point scale, indicating that the astronomy societies are effective in reaching people with little prior interest in these topics.

Number (and %) of participants*	(Disagree) 1	2	3	4	(Agree) 5
I was already interested in …	7 (6%)	12 (11%)	24 (21%)	17 (15%)	52 (46%)

* Including cubs, pupils and general public but not group leaders

Number of group leaders** (shows only)	1	2	3	4	5
I was already interested …	1	1	5	1	1

** Including cub leaders and teachers, answering on their own behalf

Those participants who self-identified as interested in astronomy/physics were more likely also to have answered positively to the other science capital questions (see figure 11).

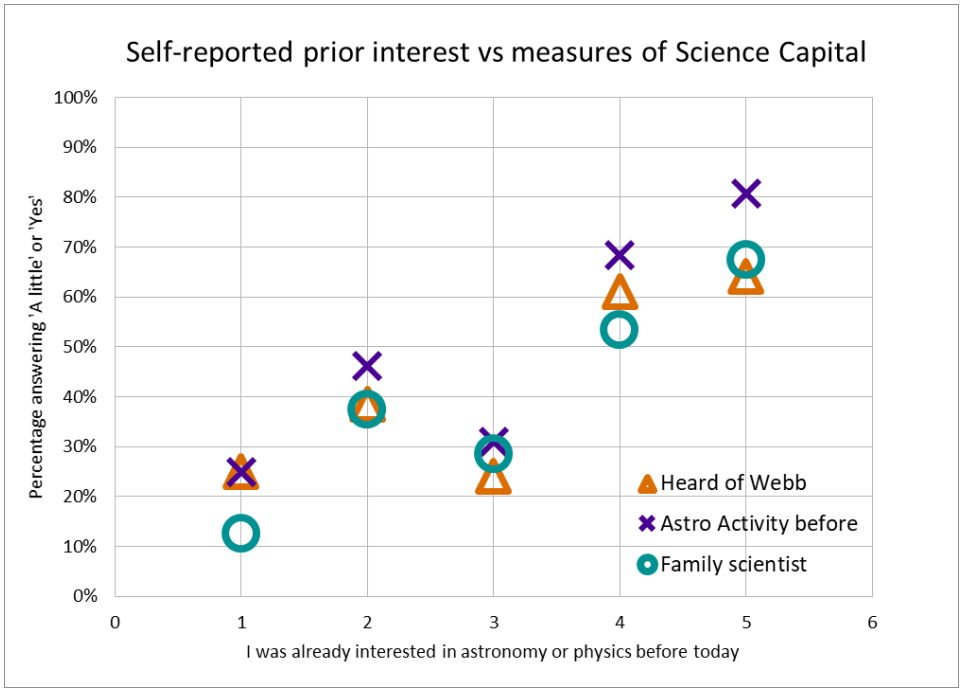


Figure 11: indicators of participants' Science Capital

5.5.3.3 Timing of activities (dwell time)

Show lengths mostly varied from 25-30 minutes, plus one instance of 80 minutes at an adult event. In all but one instance these were followed by 10-15 minutes of Q&A.

Every recorded show was followed by additional use of AstroBoost activities for 24-40 minutes. Other post-show activities included stargazing, use of telescopes and display boards.

Other events included drop-in stands including at New Scientist Live (on the British Astronomical Association stand), at a University of Surrey Physics department event, and a RAL Stargazing event. Dwell times were not recorded for these.

5.5.4 Communication of Webb science

5.5.4.1 Outcomes: Webb as a topic for AS delivery

Astronomy society members delivering the activities were asked whether they agreed with the statement "I would have mentioned Webb anyway, without the AstroBoost resources", and/or "AstroBoost meant I talked *more* about Webb". They were also asked whether they agreed "Webb is an interesting topic to talk about". Answers were given on a scale of 1 (disagree) to 5 (agree).

Responses clearly indicate that AstroBoost succeeded in getting Webb science out via an existing network that otherwise would have been much less likely (or even unlikely) to present this topic. It has also increased the subject knowledge of this group of influencers.

Every AS respondent agreed that Webb was an interesting topic to talk about, although most disagreed that they would have presented it without AstroBoost.

Number of AS members	(Disagree) 1	2	3	4	(Agree) 5
I would have mentioned Webb anyway	2	4	1	1[1]	0
AstroBoost meant I talked *more* about Webb	0	0	0	1	7
Webb is an interesting topic to talk about	0	0	0	5	4
I myself learned new things about Webb as a result of AstroBoost	0	0	0	3	5

[1] A note from the respondent who answered 4 to the first question commented "one of the requirements of the Cubs Astronomy badge is to find out about space missions. I usually mention 6-8 ESA missions with UK involvement as examples."

During observation visits to events, the following comments were noted:

Cub leader: [being asked if the topic was appropriate] "Yes absolutely; it's interesting".

Yr 5 teacher: "They were all interested", but also that "everything about waves was too much for them" and [it would have been good if it had] "more focus on the telescope".

Yr 5 teacher: "[the children were] intrigued by the infrared more than the telescope."

The content about light as a wave had been intended only for use with KS3+ groups, but this was included in every presentation that was observed including for younger children. This may have been too difficult a concept for most younger children to tackle and was discussed with the societies in the summative focus group. That said, one yr5 child was excited to report during an observation visit that this had allowed him to correct a prior misconception that colour had no meaning in physics and was a purely physiological phenomenon.

5.5.4.2 Outcomes: DO

Respondents were asked whether they agreed with the statements "I expect to tell other people about Webb" and/or "I will look out for future Webb news".

Positive responses (ie 4 or 5) from non-leader participants were 66% for "tell other people" and 77% for "news". It is not possible to tell if this will translate into action, but it does suggest positive intention.

Number (and %) of participants*	(Disagree) 1	2	3	4	(Agree) 5
I expect to tell other people about Webb	2 (2%)	14 (13%)	22 (20%)	34 (31%)	38 (35%)
I will look out for future Webb news	4 (4%)	6 (5%)	16 (14%)	32 (54%)	54 (48%)

* Including cubs, pupils and general public but not group leaders

Number of group leaders**	1	2	3	4	5
I expect to tell other people about Webb	0	1	4	2	2
I will look out for future Webb news	0	0	5	2	2

** Including cub leaders and teachers, answering on their own behalf

A Cub leader wrote in a thank-you email: "Now that I know about it, I shall certainly watch out for news about the James Webb space telescope over the next few years!"

During observation visits to events, the following were noted:

A Cub leader commented: "Most of them will go home to talk about it". Being asked whether the topic was appropriate, another Cub leader replied "Yes, because then you get their interest going and they will probably research it themselves".

Year 5 children who had seen the show and were exploring the activities were asked by their teacher what they might tell people at home about it all. Replies were:

- "A new telescope going out in a couple of years"
- "Camera thing … take pictures of stars"
- "About astronomy, what's at the end of the rainbow, how rainbows are made"
- "There's a never ending rainbow"
- "Not all people and insects see the same thing"

5.5.4.3 Outcomes: FEEL

Respondents were asked whether they agreed with the statements "I enjoyed the talk" (or "I enjoyed the Webb/infrared activities", depending on which type of event they attended). Most agreed.

Number (and %) of participants*	(Disagree) 1	2	3	4	(Agree) 5
I enjoyed the talk/activities	1 (1%)	0	12 (11%)	28 (26%)	66 (62%)

* Including cubs, pupils and general public but not group leaders

Number of group leaders**	1	2	3	4	5
I myself enjoyed the talk/activities	0	0	1	3	5

** Including cub leaders and teachers, answering on their own behalf

During observation visits to events, the following were noted:

Cub leader: "Even us adults were interested in listening and learning."

5.5.4.4 Outcomes: VALUE

Respondents were asked whether they agreed with the statement "I feel pride that the UK helped build Webb". Note the wording for group leaders was slightly different.

Number (and %) of participants*	(Disagree) 1	2	3	4	(Agree) 5
I feel pride that the UK helped build Webb	2 (2%)	2 (2%)	12 (11%)	26 (24%)	65 (61%)

* Including cubs, pupils and general public but not group leaders

Number of group leaders**	1	2	3	4	5
Since hearing the talk I am more likely to feel pride that the UK helped build Webb	0	0	3	4	2

** Including cub leaders and teachers, answering on their own behalf

A response to the question "What was the most interesting thing":

"That in UK they send lots of interesting telescopes"

5.5.4.5 Outcomes: SKILLS

There were no learning objectives related to skills, nor was this evaluated.

5.5.4.6 Outcomes: UNDERSTANDING

Respondents were asked whether they agreed with the statement "I understand telescopes better now", and AS members were asked whether they had learned new things about Webb as a result of the project.

Number of participants*	(Disagree) 1	2	3	4	(Agree) 5
I understand telescopes better now	3[1] (3%)	0	20 (18%)	33 (29%)	57 (50%)

* Including cubs, pupils and general public but not group leaders

Number of group leaders**	1	2	3	4	5
I understand telescopes better now	0	2	0	5	1

** Including cub leaders and teachers, answering on their own behalf

Number of AS members**	1	2	3	4	5
I myself learned new things about Webb as a result of AstroBoost	0	0	0	3	5

Questionnaire responses to "What was the most interesting thing" included expressions of understanding new concepts:

GCSE student (12-14yr): "Where the telescope will be located at the La Grange point and why that is".

GCSE student (adult): "Why the telescope is optimised to IR wavelengths (redshift of distant galaxies). Didn't know this".

Leader questionnaire response to "What were the best things about the talk for your group?"

"It was very interesting, great talk, activities and games all in a way we can understand"

Additional comments from questionnaires:

Cub: "I loved it thank you so much! I am learning about space in school so it's really helped me."

[1] GCSE student (adult, responded 1): "I already knew enough to be dangerous with the sharp end."

During observation visit:

Yr 5 teacher: "Talking at them for a long time, they don't take much in. Probably don't remember about waves."

5.5.5 Support of Astronomy Societies

One of the three stated aims of this project was "to develop a new mechanism to support astronomy societies in delivery of high quality public engagement activities".

All the societies agreed that the project was a success in this regard, as they received useful resources that were suitable for their needs. They found the project to be very worthwhile and "no trouble".

The resources not only provided activities and a talk, but also useful tips and information about science communication in general, such as tips for dealing appropriately with volunteers and consideration of gender.

There was a feeling that RAS is "taking a bit more notice of Astronomy Societies", something is "Potentially starting to happen".

All the partner societies (and many of the surveyed societies) were interested in a potential Phase 2 project to build upon the impact of AstroBoost and involve more societies. Interest was also raised from societies in other parts of the country.

5.5.6 Informing future projects

AstroBoost has demonstrated that amateur astronomy societies are interested and willing to receive support to improve their public engagement work. The survey shows that about two thirds of societies are keen to increase their audiences, but lack resources to do so.

Takeaway points for similar future projects:

- Yes you can provide resources to AS groups and they will use them to communicate your science! And such projects can be run smoothly and effectively. The partner AS groups were agreed on many issues which made the project easy to steer.

- AS groups generally have only a small core of members driving activity, which is a major barrier to increasing their audiences. It would be interesting to look at ways to encourage inexperienced members to have a gentle entry to public engagement, and to observe activities in action.

- The partner AS societies were competent and happy to take resources and adapt these for their own purposes. But this takes time and effort; usage is still evolving after six months of delivery.

- Hands-on activities and handling objects are not broadly used by AS groups, but are suited to their contexts and welcomed by both them and their audiences. They also offer a gentler entry for members new to public engagement. There is opportunity here to develop communication practices within the AS community by demonstrating methods and providing resources.

6 Networking and other Project Outcomes

Relating to project Aim 2.

Alastair Bruce of the Webb Campaign attended the formative focus group and training event, with opportunities for free discussion with AS members.

As part of the project, Nicky Fleet (NAS) attended the RAS's RASreach event in London to talk about the project. Through AstroBoost (and then SAGAS), invitations to this meeting were sent to all SAGAS members, acceptance not requiring membership of RAS.

At least one AS member became a STEM Ambassador as a direct result of hearing about this scheme through AstroBoost.

At the summative focus group, the partner societies expressed that they had found it very interesting and useful to be able to share and discuss public engagement practice between their societies. They agreed an intention to run a cross-AS outreach discussion session after the October 2019 SAGAS meeting.

NAS stated the project had "Given us the opportunity to think about up-skilling" [our members]

GAS report being "inundated with Cubs enquiries", this very likely due to the regional Cubs leader who saw AstroBoost activities in action and is known to have recommended these to other packs in her region.

7 Project Reporting

Relating to project Objectives 8-11:

> Obj 8: Production of an end of project report. (Feb 2019.)
>
> Obj 9: Project report made available for download from RAS website (assuming new website design allows), and from the Webb Campaign website. The latter also to include access to assets that may be shared. (Feb 2019.)
>
> Obj 10: Project report sent to SAGAS and FAS, and the project briefly summarised on the PSCI-COMM, BIG-chat, Dome-L and BAP email lists, with a link to access the full report. (Feb 2019.)
>
> Obj 11: Session proposals submitted to present the project at the 2019 SAGAS Convention (Summer 2019) and British Association of Planetaria 2019 conference (Sept 2019).

This report was submitted in March 2019 (project end date 29 March 2019) and may be downloaded from https://www.ras.org.uk or https://www.jwst.org.uk/articles/astroboost/ .

A short summary including overview of the available materials and link for download was sent out via the science communicator email lists PSCI-COMM, BIG-chat, Dome-L and BAP-L. FAS and SAGAS have commited to send a similar email to their astronomy society members.

The AstroBoost project was presented before completion, by JS unless otherwise stated, at:

- SAGAS meeting, Clanfield, 28 October 2017 (before project was funded)
- British Association of Planetaria conference, Birmingham, 7 September 2018
- European Week of Astronomy and Space Science, Liverpool, 3 April 2018 (by Olivia Johnson, Webb Campaign)
- SAGAS meeting, Clanfield, 21 April 2018
- RASreach event (Royal Astronomical Society), London, 27 June 2018 (by Nicky Fleet, NAS)

The AstroBoost project has confirmed sessions to be presented after completion by JS at:

- British Astronomy Weekend, Winchester, 7 April 2019
- Royal Astronomical Society Education and Outreach Committee meeting, London, 16 May 2019
- Universal Space meeting (STFC-funded Webb/planetarium project), Leicester, 10 May 2019
- British Association of Planetaria conference, Leicester, 27-28 Sept 2019

The formulation of the SAGAS convention, summer 2019, did not allow for this style of session within the programme. However the partner societies have plans for a display to demonstrate/share AstroBoost resources.

Appendix 1 – list of Astronomical Societies in survey region

1. Adur Astronomical Society (West Sussex)
2. Andover Astronomical Society (Hampshire)
3. Basingstoke Astronomical Society (Hampshire)
4. Bournemouth Natural Science Society, Astronomy Section (Dorset)
5. Brighton Astro (East Sussex)
6. Cody Astronomical Society (Hampshire)
7. Crawley Astronomical Society (West Sussex)
8. East Sussex Astronomical Society (East Sussex)
9. Eastbourne Astronomical Society (East Sussex)
10. Farnham Astronomical Society (Surrey)
11. Fordingbridge Astronomers (Hampshire)
12. Foredown Tower Astronomers (East Sussex)
13. Guildford Astronomical Society (project partner, Surrey)
14. HantsAstro (Hampshire)
15. Hampshire Astronomical Group (project partner, Hampshire)
16. Horsham Astronomy Group (West Sussex)
17. Lewes Astronomers (East Sussex)
18. Newbury Astronomical Society (Berkshire)
19. Reading Astronomical Society (Berkshire)
20. Seven Sisters Astronomical Society (East Sussex)
21. Solent Amateur Astronomers (Hampshire)
22. Southampton Astronomical Society (Hampshire)
23. South Downs Astronomical Society (West Sussex)
24. Test Valley Astro (Hampshire)
25. The Local Group (East Sussex)
26. Wadhurst Astronomical Society (East Sussex)
27. Wessex Astronomical Society (Dorset)
28. Weymouth Astronomy Club (Dorset)
29. Worthing Astronomical Society (West Sussex)
30. Vectis Astronomical Society (Isle of Wight)

Appendix 2 – survey questions

Astronomical Society survey 2018

Survey of AS outreach / public engagement activities in the SAGAS region, by Dr Jenny Shipway on behalf of RAS. This survey is part of the AstroBoost STFC-funded project, run in partnership with Hampshire AG, Guildford AS, Newbury AS and JWST. Findings will be shared with SAGAS and FAS, and be available for download from the RAS and JWST websites. If you would prefer any of your information to be anonymised, then please do let me know and this can be arranged.

Survey aim: to shine a light on current activities to help inform future funded projects that could support AS in their activities.

IF YOUR GROUP DOES NO OUTREACH - please do still answer! The form will be especially quick for you to fill in.

Accuracy: estimates or partial information is fine; just put in what you can. There are places you can leave me a note to flag up if anything is a completely wild guess. If you later access more accurate numbers/info, then you can edit your form entry or email these to me at jennyshipway@gmail.com.

*Required

1. **Name of Astronomical Society** *

2. **Optional: change contact details (if I should use a different email/contact in future)**
   Contact details will not be included in the report. If I got it right first time then you can leave this blank.

3. **Number of members (approximate is fine)** *

4. **Does your group consider outreach / public engagment within its aims? (ie communicating astronomy topics to non-members*.)** *
   *Not including communicating with academic astronomers or other AS group members.
   Mark only one oval.

   - ◯ Yes - stated in official documents (eg consitution, or AGM minutes)
   - ◯ Yes - generally recognised as an objective, but only on an unofficial basis.
   - ◯ No

5. **Has your group been associated with public observing, talks, social/mass media, display stands, web articles, or any other public engagement activities over the past year?** *

Please include activities where the aim was to recruit new members, and/or where members supported events run by other organisations. Activities aimed primarily at members still count if there is any attempt to make these available also for the public. But please do not include activities that are part of the joining process (ie for people who have already decided they will join the group).
Mark only one oval.

- ◯ Yes.
- ◯ Not aware of any such activities. (Please skip past the following five questions).

6. **Who in your group is involved in public engagement?** *

Over the past year, who has taken part in these activities? If 'other', please give details. You can also select 'other' if you just want to give more details than the other choices allow (please do if you can!).
Mark only one oval.

- ◯ One or two members each doing their own thing.
- ◯ Always the same small core, very few others ever involved.
- ◯ A small core of organisers, supported by other members who come to help at big events.
- ◯ Lots of people! Most of our members are involved in one way or another.
- ◯ Other: _____

7. **What have your members done in the last year, and for whom?**

If I've missed anything, then just add it in the next written section.
Tick all that apply.

	School group 5-11yr	School group 12-16yr	Cubs / Brownies	Scouts / Guides	Adult group	General public: families	General public: adults	Other
Lecture (eg Powerpoint talk)	☐	☐	☐	☐	☐	☐	☐	☐
Lecture with demonstrations	☐	☐	☐	☐	☐	☐	☐	☐
Visual display: posters, photos, info	☐	☐	☐	☐	☐	☐	☐	☐
Informal chats	☐	☐	☐	☐	☐	☐	☐	☐
Handling objects (touch/look only)	☐	☐	☐	☐	☐	☐	☐	☐
Interactive hands-on activities (using materials to achieve something)	☐	☐	☐	☐	☐	☐	☐	☐
Mass media (eg radio, TV, print) interview or providing information	☐	☐	☐	☐	☐	☐	☐	☐
AS website (eg articles, photos)	☐	☐	☐	☐	☐	☐	☐	☐
Social media	☐	☐	☐	☐	☐	☐	☐	☐

8. **Anything else?**
   Tick all that apply.

	School group 5-11yr	School group 12-16yr	Cubs / Brownies	Scouts / Guides	Adult group	General public: families	General public: adults	Other
Interactive workshop (with a beginning, middle and end)	☐	☐	☐	☐	☐	☐	☐	☐
Formal course / lesson	☐	☐	☐	☐	☐	☐	☐	☐
Tour of observatory facilities	☐	☐	☐	☐	☐	☐	☐	☐
Observation - solar telescopes	☐	☐	☐	☐	☐	☐	☐	☐
Observation - telescopes at night	☐	☐	☐	☐	☐	☐	☐	☐
Observation - binoculars	☐	☐	☐	☐	☐	☐	☐	☐
Observation - naked eye	☐	☐	☐	☐	☐	☐	☐	☐

9. **How many people have these types of event reached in the last year?**
   Please estimate as well as you can how many people you've reached over the past calendar year. Where possible, using the categories above. Eg "Three family observing nights with telescopes and staffed displays for roughly 50 visitors each time, and one talk with Q&A to a class at a primary school". Any/all additional info is very welcome also - don't hold back! Having numbers will help everyone with future fundraising.

10. **Why do you do these things?**
    What are your / your members motivations in their public engagement? Why is it important, what do you hope to achieve? What would you consider as a succesful outcome from these activities? It is likely different members will have different motivations, and so please enter all that apply, highlighting any more important drivers. And yes you can include 'because it's fun'!

11. **--- EVERYONE FILL IN THE FOLLOWING QUESTIONS PLEASE! ----**

12. **What gets in the way of your doing any/more outreach?** *
What are the barriers to your group doing any / more / better quality outreach?

13. **What would you aspire to do in future?** *
If all those barriers magically vanished, what would your ideal vision be of what your particular group could be doing? What level of activity would be appropriate for your group? (If none, then a quick word about why this isn't a fit for your group would be really helpful, if you haven't already explained this above).

14. **Might you be interested in being part of AstroBoost phase 2?** *
AstroBoost phase 2 would develop/provide resources for AS groups to help them start or further develop their public engagement activities. Resources might include training, practical items like banners and tablecloths, and/or communication aids like models and hands-on activities. The project would likely start in spring 2020.
Mark only one oval.

- ◯ Very likely / Yes
- ◯ Maybe
- ◯ Unlikely / No

15. **Anything else that I should have asked or you could contribute to this survey?:**

Appendix 3 – list of resources provided

Numbers are per kit (three kits were produced).

Appendix 3.1 Documents

All printed documents were included on the USB stick unless otherwise indicated.

3.1.1 Electronic versions (USB stick):

- AstroBoost Powerpoint presentation as used during training
- Powerpoint presentation for the Webb show with demos
- Lego Webb building instructions (printed/cut copies provided with model kits)
- Receipts / invoices, showing where things were purchased and costs

- Risk assessment templates for:
    - General display stand
    - Webb show with demos
    - Hershel experiment
    - Print tray activities

3.1.2 Evaluation folder (box file):

- A4 sign to display by feedback box
- 130x child questionnaires for show delivered to groups 8-12yr
- 15x leader questionnaires for show delivered to groups 8-12yr
- 150x Self-led questionnaires for drop-in stands (for all ages)
- 15x astronomy society member questionnaires for delivery team
- 7x Show and 10x Event record sheets (for AS event leader)

3.1.3 Resource folder (ring-binder):

- Webb show with demos – script & content

- Destination Space phase 2 handbook (for Webb background, only relevant sections printed)
- Infrared camera – helpsheet
- Learning – helpsheet
- Volunteers - helpsheet
- Replica spacecraft parts – helpsheet (provided by UK Web Campaign)

- Prism activities – activity sheet
- Camera activities 1 – activity sheet
- Camera activities 2 – activity sheet
- Cold Webb – activity sheet
- Hershel experiment – activity sheet
- Print tray activities – activity sheet

- Spectroscopy glasses and more – activity sheet
- Additional camera activities – activity sheet

Appendix 3.2 Physical resources

3.2.1 General

- USB stick with digital resources
- Folder with printed copies of written activity resources
- Folder with printed copies of evaluation resources

- Pull-up banner (designed by Steve Wilkins, Sussex University)
- Really Useful Boxes for resource storage/transport

- 15x Webb pin badges for AS delivery team (created and provided by Steve Wilkins)

- Feedback box
- 3x freestanding A4 sign holders

3.2.2 Show-related resources

- 3D printed Webb model (RAS hold a spare in case of loss or breakage)

- LED magnifier with 4x AAA batteries
- Replica MIRI pupil masks (arranged by UK Webb Campaign)
- MIRI bolts (provided by UK Webb Campaign)
- Other similar non-space-flight bolts (provided by UK Webb Campaign)

- Powerpoint clicker
- 4x AAA batteries
- Mini dustpan and brush (for glass breakages)

- 20x gold hexagon sections for building Webb's mirror (fabricated by Dave Hills)

- Spray bottle for water
- Glass prism (boxed)
- Plasticine (to create base for Prism)
- Red filter in frame

- Ultra-violet torch
- 3x AA batteries
- Samples of bleached and unbleached paper

- Flir C2 camera (with basic accessories)
- Mini tripod for camera
- 2m USB cable for camera

- Heat pad (Beurer HK35)
- 100x Mini lego Webb model kits (design from UK Webb Campaign, sourcing by Steve Shipway)

- Materials taped to bamboo canes (bin bag and Mylar)
- Black tape and bamboo canes for construction using additional materials

- Flip-up Scoreboard
- Spare Mylar sheets

- Sheet of cardboard

- 2cm “Earth” bead on thread, + 1 spare bead
- 0.6mm “Moon” bead on thread, + many spare beads
- Webb representation (six gold hexagonal beads) on 2.4m length of thread + spare beads

- Tape measure
- Compressed air cannister
- Bicycle pump

3.2.3 Resources not designed to be used in the show

- Wooden printers-style tray, spray-painted black
- Bin-bag material (multiple layers), taped at edges to create lid for printers-style tray
- 17 steel ball bearings (3/4 inch)

- 17 clear latex balloons
- 30 pairs Spectroscopy glasses
- Three matched spirit thermometers

- Webb stickers (provided by UK Webb Campaign / Steve Wilkins)
- Webb postcards (provided by Steve Wilkins)

Appendix 4 – evaluation questionnaires

Appendix 4.1 Delivery Team questionnaire

Webb activities – Delivery Team feedback

You only need to fill this form in once per person. Add extra information at subsequent events as required. Staple on extra sheets if you have more to say.

Did you attend the training day? ☐ Yes ☐ No

Had you delivered public engagement activities before? ☐ Yes ☐ No

How old are you? ☐ Under 20yr, age ..... ☐ 20 – 64 yr ☐ 65 yr +

Gender ☐ M ☐ F ☐ Other ☐ Rather not say

	Disagree 1	2	3	4	Agree 5
I would have mentioned Webb anyway, without the AstroBoost resources	☐	☐	☐	☐	☐
AstroBoost meant I talked *more* about Webb	☐	☐	☐	☐	☐
Webb is an interesting topic to talk about	☐	☐	☐	☐	☐
The activities worked on a practical level	☐	☐	☐	☐	☐
The activities were suitable for the audience	☐	☐	☐	☐	☐
The activity information sheets were good	☐	☐	☐	☐	☐
I myself learned new things about Webb as a result of AstroBoost	☐	☐	☐	☐	☐

If you have delivered the talk, which demos have you included within the talk?

- ☐ Water spray to make rainbow
- ☐ Prism to make spectrum
- ☐ Colour filters for spectrum
- ☐ Look at people with IR camera
- ☐ Box trick with IR camera
- ☐ Opaque/translucent materials
- ☐ Cardboard trick
- ☐ Where is Webb
- ☐ De/pressure gas demo
- ☐ Other (name below)

Please continue overleaf ...

Which activities have you used separately from the talk?

- ☐ Water spray to make rainbow
- ☐ Prism to make spectrum
- ☐ Colour filters for spectrum
- ☐ Look at people with IR camera
- ☐ Box trick with IR camera
- ☐ Opaque/translucent materials
- ☐ Cardboard trick
- ☐ Where is Webb
- ☐ De/pressure gas demo
- ☐ Print tray / ball bearings
- ☐ Diffraction glasses
- ☐ Replica part

Have you delivered any *other* activities related to AstroBoost, IR or Webb?

Which demos / activities / resources did you find the most useful? Why?

Which demos / activities / resources did not work so well for you? Why?

Appendix 4.2 Group leader questionnaire (for shows)

Webb Telescope talk – feedback

My role ☐ Teacher / main group leader ☐ TA / assistant leader

Gender ☐ M ☐ F ☐ Other ☐ Rather not say

Had you heard of the Webb telescope before?	☐ No	☐ Yes
Had you *yourself* done any astronomy activities before?	☐ No	☐ Yes
Does anyone in (or close to) your family have training, expertise or a job in science?	☐ No	☐ Yes

	Disagree 1	2	3	4	Agree 5
I was already interested in astronomy or physics before today	☐	☐	☐	☐	☐
I myself enjoyed the talk	☐	☐	☐	☐	☐
I myself understand telescopes better now	☐	☐	☐	☐	☐
I expect to tell other people about Webb	☐	☐	☐	☐	☐
I will look out for future Webb news	☐	☐	☐	☐	☐
I feel pride that the UK helped build Webb	☐	☐	☐	☐	☐
I am now *more* keen and/or confident for for the group to do future astronomy activities	☐	☐	☐	☐	☐

What were the best things about the talk for your group?

How could this talk be improved to make it more appropriate for your group?

If you have any other comments or thoughts you want to share, we'd love to read them too! You can write them on the back of this paper. Thank you.

Appendix 4.3 Participant questionnaire (for shows)

Webb Telescope talk/activities – feedback

Please tick the boxes, then write in the big spaces at the bottom of the page.

My school year group ☐ yr 3 – 6 ☐ yr 7 - 9 ☐ None/other, age .....

Gender ☐ Male ☐ Female ☐ Other ☐ I'd rather not say

Had you heard of the Webb telescope before?	☐ No	☐ Yes
Had you taken part in any kind of astronomy activity before?	☐ No	☐ Yes

	Disagree 1	2	3	4	Agree 5
I was already interested in astronomy or physics before today	☐	☐	☐	☐	☐
I enjoyed the talk	☐	☐	☐	☐	☐
I understand telescopes better now	☐	☐	☐	☐	☐
I expect to tell other people about Webb	☐	☐	☐	☐	☐
I will look out for future Webb news	☐	☐	☐	☐	☐
I feel pride that the UK helped build Webb	☐	☐	☐	☐	☐

What was the most interesting thing you learned?

Which bit of the talk was the most confusing?

If you have any other comments or thoughts you want to share, we'd love to read them too! You can write them on the back of this paper. Thank you.

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Webb Telescope activities – feedback

The Webb / infrared resources were provided by a funded project. To judge the success of this project, we would like to know who used the activities, and what you thought.

If you share this form, please use a different colour pen for each person.

How old are you?

☐ 0 – 4 yr ☐ 5 – 7 yr ☐ 8 – 11 yr ☐ 12 – 14 yr

☐ 15 – 16 yr ☐ 17 – 19 yr ☐ 20 – 64 yr ☐ 65 yr +

Gender ☐ M ☐ F ☐ Other ☐ Rather not say

Had you heard of the Webb telescope before?	☐ No	☐ Very little	☐ Yes
Had you done astronomy activities before?	☐ No	☐ Very little	☐ Yes
Does anyone in (or close to) your family have training, expertise or a job in science?	☐ No	☐ Very little	☐ Yes

	Disagree 1	2	3	4	Agree 5
I was already interested in astronomy or physics before today	☐	☐	☐	☐	☐
I enjoyed the Webb/infrared activities	☐	☐	☐	☐	☐
I understand telescopes better now	☐	☐	☐	☐	☐
I expect to tell other people about Webb	☐	☐	☐	☐	☐
I will look out for future Webb news	☐	☐	☐	☐	☐
I feel pride that the UK helped build Webb	☐	☐	☐	☐	☐

What did you enjoy most about these activities? Why?

If you have any other comments or thoughts, we'd love to hear them too. Please write them on the back of this paper.

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