

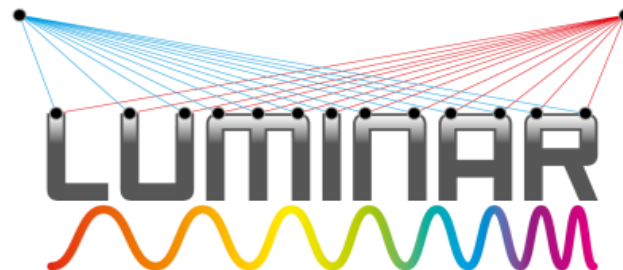


Working with Industry

Experiences from IND53 'LUMINAR' and
tips for future JRP

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Dimensional Metrology, NPL

IND53 Coordinator & Impact WP Manager



Summary



- Introduce me and the LUMINAR project
- Challenges for LUMINAR to solve
- Impact coming from LUMINAR
- Dealing with industry as partners
 - Benefits
 - Issues
 - Solutions

Introduction

Me

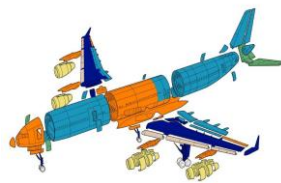
- Science Area Leader, Dimensional Metrology, NPL
- 28 years experience as length metrologist
- JRP IND53 'LUMINAR' Coordinator and Impact WP leader
- Long-standing interest in aviation...

The research area

- Large volume dimensional metrology (1 m to 50 m), in 3D
- In a factory environment

Who are the end users

- Aerospace: Airbus, Boeing, GKN, Rolls-Royce, ...
- Science: CERN, ESRF, ITER
- Other: beam-line therapy units, 'Factory of the Future', civil nuclear build, shipbuilding, automotive



LUMINAR

End-user perspective



Bigger is better challenging



LUMINAR

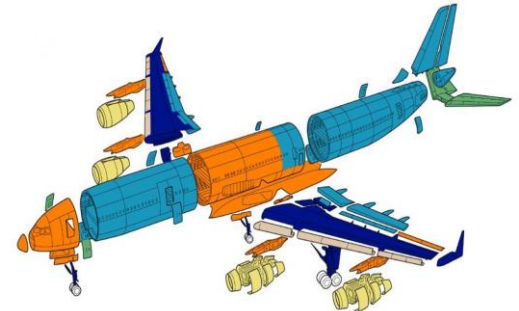
End-user challenges



Aerospace

- *EU Clean Skies Initiative*
- Lighter weight airframe (no shim) – reduced fuel burn (cost-saving, environmental benefit)
- Natural laminar flow wings - better efficiency

Control of manufacturing to 100 μm on 40 m wing (SOA 400 μm)
In a factory environment. International measurement traceability.



LUMINAR

End-user challenges

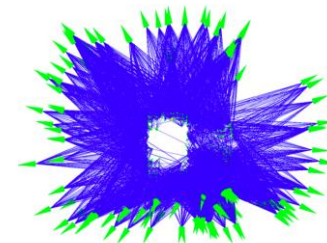


High value/future manufacturing

- Cut once, no mistakes (1 year lead times)
- Factory environments not laboratories
- Thermal compensation, measure fast/control loops
- Examples: aerospace suppliers, civil nuclear build, beam-line treatment centres, reconfigurable 'factory of the future'

Need 100 μm in 15 °C to 30 °C factory (SOA 200 μm but slow).

Autonomous machining, assembly, 3D/6D.



LUMINAR

End-user challenges



Big science

- Aligning LHC replacement: 10 μm in 200 m, 25 km tunnel
- ESRF, ITER: 80 μm over a 850 m circumference
- ESA satellite sub-system alignment: angular alignment
- ESA satellites: monitor/control unfurling/extending
- Difficult environments, very large structures



Existing impact from LUMINAR (3 weeks since end)

- CERN – LHC successor – metrology for the alignment
NPL FSI targets **installed** in the pre-cursor; **invited** to CERN workshops; discussing staff exchange/training; sold pre-FSI system to CERN; **asking** for copy of latest FSI system;
- NPL's FSI technology – commercial exploitation
IND53 has 5 patents applied for – 3 already granted (around **1/6 of entire EMRP/EMPIR**); joint patent during JRP; **collaboration agreement** being drafted with metrology company; eventually will be for indoor use what GPS is for outdoor use;
- PTB's advanced laser tracer – commercial exploitation
2 patents for PTB; commercialisation discussions with instrument manufacturer;
- NPL's LVM expertise – recognised internationally
NPL tracker calibration technique cited in **draft ISO standard**; NPL invited to take over LVMC conference; **NPL training** major presence at CMSC conference (including training delivered by NPL at CMSC and LVMC);
- Stakeholders eager to see the outputs – offered funding
Boeing asked if they can support the project through additional **funding**
National funding source – application underway to advance the system
Airbus asking about using NPL's technology in **future test building**
INRiM system being demonstrated to **machine tool** company

What I did not mention:

- **8 journal papers**
 - Industry does not read journal papers
 - They read trade magazines
 - So we ensured 3 trade magazine articles (2 during, 1 post JRP)
- **30 conference presentations/posters**
 - Industry does not attend scientific conferences
 - They go to trade shows
 - End of project workshop – showcase outputs, gather feedback, plan successor JRP
- **8 metrology committee interactions**
 - Metrology should be hidden
 - Standards may be of interest

How to plan to deliver this impact ?



The impact WP leader should have the easiest job in the whole JRP 😊

Why?

1. JRPs are always designed to deliver impact
2. The most impactful JRPs are those which are selected for funding
3. Routes to impact formed the project plan for the JRP
4. If everybody works as planned, impact is automatic

How it should work – impact focused

1. Find an important challenge
2. Identify the metrology need(s) of the challenge
3. Work out the routes to achieve best impact
4. Survey NMIs/DIs to see which of these routes they could follow
5. Plan the JRP maximising impact routes
6. Deliver the JRP and inform MSU of the impact as it happens
7. Watch the impact continue after the JRP ends

How it usually works! Impact as afterthought.

1. Note existing research that needs some more money
2. Rename it to fit into the next EMPIR call
'xxxx, for industry/energy/environment/SI'
3. Find some other NMIs/DIs in a similar situation and agree on a topic which you can all fit into – prepare PRT
4. Plan the project so everyone does what they want
5. Force someone to be Impact WP leader
6. Ask them to work out how the project will generate impact
7. Try to identify impact in the 60 days after the JRP ends before the reports are due...

In reality, JRPs are put together in a process somewhere between these two extremes.

There are good intentions, led by impact

But everyone is on holiday at some point over the summer

There is inevitable duplication to some extent

National budgets sometimes mean non-optimal participation across the portfolio (some projects miss out or are over-subscribed)

So, why bother?

Large organisations are a route to significant impact:

- 1 % improvement on a €multi-bn business is of high value
- They have impact routes to/across many sectors/initiatives
- They touch the lives of many citizens
- They can fit a small project into their grand operation
- Large 'tier 1' organisations influence tiers 2, 3, ...
- Easier to 'sell the JRP' to the referees 😊

Being significant



Understand that you are insignificant unless you can make a significant difference

A UK aerospace company saved €5M p.a. by changing the design of a single type of bolt

JRP IND53 is €3M

Make their participation obvious to them and as smooth as possible

Tips and tricks – from LUMINAR



Making it smooth for industry to participate

- Timing - last of the contracts issued before they went from R&D cycle to production cycle
- By not tying up large facilities or staff budgets
- Being upfront at the start that it was both Airbus & Boeing
- Allowing them to be flexible in their offering – use them as both an unfunded partner and an end-user (no ‘surprises’ at the end)

Possible issues we had to work around

- Asking them to commit to us using something 3+ years later – flexibility
- Agreeing all Airbus IP was excluded unless explicitly requested and delivered (and they agreed to it)
- Change of contact staff member (higher staff mobility than NMIs)

Find issues common to all the big players, not just something unique to one (who has competitors) and show the solution in a way they can appreciate in terms of their business

JRP IND53 has both Airbus and Boeing as unfunded partners, happy to collaborate on common issues provided they both can see the benefit – JRP outputs demonstrated at both locations (i.e. on site, not just at the NMIs)

Become their friend some time before considering a JRP

JRP IND53 had only 4 months to negotiate the participation of Boeing and Airbus and to get written agreement to this effect

We actually started on this some years before...

A successful JRP starts 3-4 years before the Call

- Horizon scanning of upcoming challenges (5 to 10 years away)
- Find out & understand internal cycles of large organisations
- Listen to their metrology needs (and timescales) – JRP focus
- Do previous (small, national) work with them (so you are not 'new' to them)
- See which conferences they attend (at an 'engineering level') - attend the same conferences and even offer to run them for them! (Helps find out generic issues)
- Get them to visit you and vice versa (gets them used to your 'science', you used to their 'business')
- Find a champion within the organisation who has both a metrology need and some 'engineering/science' background
- Maintain regular contact in the run-up to a Call
- Don't expect them to attend all meetings, prepare items for them as much as possible
- If possible have an outline of your JRP ready in the year before the Call
- Focus on the business, science comes later

Thanks to the LUMINAR team



Advanced Manufacturing Research Centre

