Kent RFA SCBA Evaluation and field trials

The KFRFA has utilized MSA self-contained breathing apparatus (SCBAs) since the late 1980’s. The units have been well maintained by the SCBA technicians at station 75; including significant manufacturer and NFPA required service and re-builds. However, the equipment is 2 NFPA cycles old and over 10 years of service life. The problem was exacerbated by the consolidation with SeaTac, which placed a greater percentage of the SCBAs in first-line service. Our SCBA technicians have faced a challenge in keeping enough units in service as this model is no longer manufactured and parts for repair are becoming harder and harder to find.

In 2011 the KFRFA participated with other Zone 3 departments in an exhaustive study to determine, at that time, the best SCBA product. All potential SCBA brands were tested and the SCOTT air pack was rated the highest with an older version of MSA coming in second place. As a result of that study Scott SCBAs have been purchased by Renton, VRFA, Maple Valley and Burien. After this selection process MSA developed the G-1 model. The MSA G-1 has many features similar or superior to the SCOTT pack. Earlier this year South King Fire and Rescue performed a head to head test between the SCOTT pack and MSA G1 and as a result SKFR chose the MSA G1 over the SCOTT product.

With this background of previous testing, local department purchases, and recent innovations in SCBA’s the Kent RFA wanted to also evaluate the MSA and SCOTT air packs and use that evaluation process to help determine which brand will be chosen for this substantial long term purchase of this critical life safety component.

EVALUATION PROCEDURES

The evaluation process consisted of three parts.

- Field trials by selected subject matter experts (SME’s) within the department
- Field trials by various KFRFA members during consortium firefighter survival obstacle course training
- Interviews and networking with other agencies including review of their evaluation data.

Field Trials with SME’s

A test team of 6 members was selected using the criteria that they had no biases on either SCBA, they could be objective and that their opinion was trusted and valued in the Department. The test team was comprised of the following personnel.

- Captain Scott Galassi
- Captain Kent Knight
- Engineer Don Nelson
- Engineer Bob Tonda (also an SCBA technician)
- Firefighter Jessie Nemens
- Firefighter Jesse Wise
This portion of the evaluation consisted of a demonstration and Q & A with each SCBA manufacture representative, a field day with hands on use of the SCBA and independent time with each pack. The SME’s were asked to fill out an evaluation sheet that rated components of the SCBA system – ergonomics, communication, and mask visibility/use as well as specific functional tests – ladder raising, donning/doffing, cutting on the roof prop, search maze, and bottle changes. The test teams individual SCBA pick and comments are found in Appendix A.

Field Trials with random KFRFA personnel during obstacle course training
There was a random selection of Department personnel that tried each SCBA during the training consortium annual Fire Ground Survival. This training involved hands on practice in navigating low hanging wires, diminishing clearances, MAYDAY communications, and buddy breathing. The KFRFA personnel were asked to use the test packs during this training and fill out an evaluation afterwards. These results combined with the test team’s field trails can also be found in Appendix B. In addition unedited comments can be found in Appendix C.

Other Fire Department Interviews/ Data Review
South King Fire & Rescue (SKFR) Lt. Scott Irvin who heads up the SCBA program for SKFR was contacted regarding their recent evaluation process. Lt Irvin provided all details of the process and gave full access to the data. Central Pierce Fire was also contacted. They too recently did an MSA vs SCOTT evaluation and have since purchased the MSA G1. The Central Pierce evaluation form was modified and used as a basis for the KFRFA evaluations. In addition, other departments currently using either the SCOTT or MSA packs were contacted to gather background information and level of satisfaction with the products. Renton, Maple Valley and South King were sent questionnaire with the following questions:
1. How long have you had the packs?
2. How has the pack held up?
3. Any issues during the annual Posi-checks?
4. Do the members have any complaints?
5. How is the vendor (Seawestern or MES) like to deal with?
   a. Turn around on parts?
   b. Is the cost for parts consistent?
   c. Do they come to the station to change parts out for you?
6. Anything else positive or negative?

CONSIDERATIONS

Although the results of the evaluation clearly favor the MSA G1 other considerations in purchasing an SCBA had to be weighed.

Consideration - Interoperability between airpacks/Fire Departments

All SCBA’s have a NFPA required Universal Air Connection (UAC). A trans-fill hose is used between the UAC connections on the SCBA to share air in each bottle in potential rescue scenarios. SCOTT owns a proprietary patent on the way their UAC functions. SCOTT packs gives air SCOTT to SCOTT and receives air from an MSA but will not give air to an MSA SCBA. With SCOTT the trans-fill will only work if the supply air is higher than bottle needing air. The MSA trans-fill will equalize (share) the air between the 2 SCBA’s regardless of air pressure.
To be clear, this non compatible issue exists now and to help overcome a potential problem the RIC kits that all fire engines in the zone carry, have the capacity to give emergency air to anyone regardless of the brand of SCBA.

Training has worked to overcome this non-compatible issue. It is covered in the annual consortium SCBA training mentioned earlier as well as in ongoing departmental training. In a discussion with DC Tomlinson he advised that a training curriculum has been developed for both MSA and SCOTT including an interoperability piece for emergency trans-fill of air.

**Consideration - SCBA Bottle pressures**

Another change that SCOTT has instituted is to increase the PSI capacity of the SCBA bottle from 4500 psi to a 5500 psi bottle. It should be noted that there is no additional work time capacity with the SCOTT bottle with both brands rated for 45 minutes. The effect of this change in bottle pressures will be the costs in changing out our bottle fill stations to accommodate the higher pressure bottle requirements if the decision was made to purchase SCOTT packs. Due to our mutual aid partners changing to the higher pressure bottles our department will be upgrading the mobile fill stations on Rescue 46 and 74 regardless of the decision.

**Consideration - Purchasing Costs**

An obvious consideration is the cost to purchase a replacement SCBA system. Both the SCOTT and MSA products are recognized as the two national industry leaders. Every effort was made to ensure the bids were “apples to apples” and included all costs necessary to maintain our program. The bid quote between MES and Seawetern for an SCBA replacement with identical equipment was monetarily not a factor.

**Consideration - Maintenance costs**

It is anticipated that the annual costs to repair our aging SCBA’s will be reduced with the warranty’s that each manufacture offers.

**Consideration - Personnel considerations**

In addition to line item budget dollars it has been necessary to use overtime personnel to accomplish our WAC mandated annual testing. A hidden cost has been the large amount of time required by the station 75 crews to not only maintains the SCBA’s but to stay current on their Haz-mat skills. The program has relied heavily on senior firefighters who have a long term involvement in the SCBA program and their impending retirements will create a knowledge gap in the program. Program managers are fully aware of this issue and have been working to close that gap by training the new members of the team by having them work alongside the veterans when doing the annual testing to close the knowledge gap that exists.

Both MSA and SCOTT have made timely changes to the proposed SCBA models that will help our department through the technician “brain drain”. Industry standard is changing from FF technicians making repairs and upgrades in station to simply disconnecting the part and shipping to the respective factory for a wholesale change. It is anticipated that this change along with the new pack requiring less maintenance will greatly lessen our technician’s time and free them up for other duties. It is anticipated that either of the new airpacks will reduce the time commitment of our SCBA technicians but the SCOTT product will involve more initial training due to the unfamiliarity with the product line.
Consideration – Warranties

MSA

MSA components are plug and go. MSA offers a 15 year warranty on all parts which includes electronic parts and bottles. Departments with MSA report that have confirmation of their parts shipped under 24 hours and delivered typically 5-7 days. Seawestern (MSA dealer) is a local company that has parts in stock that speed’s up delivery considerably.

SCOTT

All SCOTT components are also plug and go. SCOTT offers a 10 year warranty on all parts and 15 year warranty on the 1st stage regulator. All electronic components are encapsulated which protects them from smoke and water damage which Departments with SCOTT have noticed less failures. Departments with SCOTT report they wait 1-2 weeks for parts depending on where they are shipped from. MES (SCOTT dealer) is building a mobile repair rig that could speed up delivery.

Inventory

When SeaTac joined the department in 2014 all of the SeaTac SCBA’s were replaced by KFRFA MSA air packs. This resulted in changes to the historical inventory levels.

Our current inventory:

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCBA</td>
<td>133</td>
<td>1-2 years of service life left-if parts are available and at a cost</td>
</tr>
<tr>
<td>Bottles</td>
<td>280</td>
<td>1-2 years of service life left</td>
</tr>
<tr>
<td>Masks</td>
<td>257</td>
<td>majority in good repair but can only be used with current SCBA</td>
</tr>
</tbody>
</table>

Proposed purchase of new SCBA system (see Appendix D for explanation SCBA distribution)

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCBA</td>
<td>137</td>
</tr>
<tr>
<td>Bottles</td>
<td>321</td>
</tr>
<tr>
<td>Masks</td>
<td>276</td>
</tr>
</tbody>
</table>

Decon

Decontamination is made easier for both packs as components can be removed and both packs can be put into a SCBA washer. The MSA can have all its soft parts removed (shoulder straps and waist straps) and these items can be placed into an extractor.

Communications

The Kent RFA has spent considerable time and money into our fire ground communications. The current communication hardware is not combatable with either SCOTT or MSA G-1. However each SCBA does have Bluetooth capability that would work similar to the system we have now. The Bluetooth systems are new and have no long term field trials to compare with as of yet. These systems are exclusive to the Motorola APX radio which the Kent RFA currently uses. The only drawback is that the SCOTT system will require an attached voice amplifier that would add weight to the mask and be prone to hanging up on obstacles.

CONCLUSIONS:
There has been a need to replace our present generation of SCBA’s. This need has been identified for several years and continues to be more critical with each passing year.

The evaluation process that was set up showed a clear preference for the MSA G1 SCBA in all areas.

In talking with other Fire Departments who have recently purchased both the MSA and SCOTT packs also shows an anecdotal preference for the MSA over the SCOTT pack.

There are issues as a Training consortium partner with going away from the recent purchase of SCOTT packs but those purchases were based on an older and inferior version of the MSA G-1 pack and regardless of the decision the fact remains that whichever pack the KFRFA chooses there will be compatibility issues with departments who already have chosen the MSA G-1 pack. The Training division has established curriculum and operational steps have been taken to manage risks associated with the incompatibility of SCBA’s.

The bid costs for each SCBA are comparable and the warranty offered by MSA is slightly better than that offered by SCOTT.

There are potential savings and streamlining with staying with the MSA brand for our technicians and maintenance components.
## APPENDIX A

**Captain Galassi**

<table>
<thead>
<tr>
<th><strong>Chief,</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>My number one pick is the MSA G-1, hands down! The mask fit and profile was excellent. I appreciated the fact that MSA has cleaned up the mask, compared to our current generation mask. I thought that the pack frame and harness were streamlined and very comfortable. The MSA G-1 seemed very easy to operate. I also really like the potential for the TIC on the chest harness pressure gauge. From my perspective, the MSA G-1 performed much better than the SCOTT in every category. On a side note, I had the 71’s B shift crew try out the packs. I did not influence them into any decision on which pack was better, and the entire crew selected the MSA G-1. Let me know if you need anything else Chief. Thank you for the work!</td>
</tr>
<tr>
<td>Scott G.</td>
</tr>
</tbody>
</table>

**Captain Knight**

<table>
<thead>
<tr>
<th><strong>MSA</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>In response to the air pack evaluation here is what I would recommend. I prefer the MSA pack for the following reasons. The face mask is sleek and has no items hanging off of it. The communications with the MSA system is superior to the Scott. Having only one power source (instead of multiple battery locations) is a selling point. I believe that with the new contact (Adrian) from our supplier that we will have exceptional customer service. Let me know if you need anything further.</td>
</tr>
</tbody>
</table>

**Engineer Nelson**

<table>
<thead>
<tr>
<th><strong>Chief Martinsen,</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>I liked the MSA pack over the Scott, both function in basically the same manner and either one would work for us. That said the MSA was a more comfortable pack with the independent waist harness that moved with you, the familiarity of the pack and its components decrease the learning curve and safety issues. The new mask was more comfortable with better visibility then the Scott. I understand that the consortium is looking to all go the same way but with only 1 dept. having made this move to Scott I think its ok for us to take the lead and go MSA. I vote for MSA!!!!</td>
</tr>
<tr>
<td>Thanks for letting me participate in the testing Chief</td>
</tr>
</tbody>
</table>

---

*Jim Schneider, Fire Chief*
Engineer Tonda  

Hey Chief,

From a performance standpoint, I like the MSA. Both the pack and the mask were more comfortable. The mask is smaller and lighter having the components both moved to the 2nd stage regulator. The Scott mask also had a distorted view when looking down. The communications seemed more reliable. Overall, the features of the MSA seemed more intuitive and user friendly which could be partially because it’s much more similar to what we have now. I didn’t think the 5500psi bottle was all it was made out to be. The size and weight didn’t seem much less. They mentioned the alarm activation pressure as being a factor in the 5500, but I don’t see a difference. It’s still a 45 minute bottle. Even if it activates at a slightly lower pressure, the work time is the same, as it’s the same volume of air.

From a tech standpoint, they are very similar. They are now much more component based, which would make us more reliable on the service/turnaround time of either company. The MSA warranty has it hands down if they stand by it. It would be nice if we could talk to other departments using both, to see what the service has been like. The MSA would also allow us to use our current RIT bags and SCBA bottles.

Thanks,
Bob

Firefighter Nemens  

Chief,

So far I feel like we would be fine using either pack. They both seem like they have made great improvements over our current packs. I am slightly leaning towards the Scott pack because I think it the frame is a little more comfortable and I like the open hole in the face piece. I really would be happy with either one and I think that we might want to consider whichever one our zone is using more of, or moving towards. I did like that the new MSA had fewer attachments on the face piece.

Thanks,
Jessi
Firefighter Wise

I would choose the MSA G-1

Positive aspects of the G1
- very easy to get on and off bottle change because of the “dovetail” guide & the quick connect.
- ergonomics, this pack has an adjustable lumbar support that can be adjusted up to approx 6” so the pack can sit higher or lower on your back.
- larger thicker straps with grip on the shoulder make it much more comfortable and the straps stay put.
- mask is very low profile, no extra components on the outside to get hung up on. The HUD is inside the mask and easy to read, & the clear-com is wired through the regulator and is located on your left shoulder strap. During testing the clear-con was very clear for radio communications even with excessive ambient noise.
- when mask is on standby they’ve fixed the fogging issue by having to large holes in the mask that make it feel like normal breathing with no restrictions unlike we have with our current masks.

Problems with the Scott
- 1/4 turn regulator into mask can be clumsy and can be turned the wrong way.
- while the fit of the pack was comfortable it is very hard to reach the bottle to turn it on while it’s on your back.
- the mask double seal feels like it floats on your face, the mask is very bulky with the HUD and the clear-com that are much larger than our current mask. The bottom of the mask has a bevel that gives it a “fisheye” lens feel.
- buddy breather (no transfill available) Scott’s are “takers” they cannot give air. This seems like a safety issue.

When buddy breathing both users of the Scott packs will breathe down the bottle with the lowest air first then they will both transfer over to the other pack and simultaneously breathe that down. If something happened that required the firefighters to break the connection one firefighter would be left with zero air in their pack. Vs the MSA pack that will transfill -or- breathe the pack with the most air until both bottles are equal and then they will breathe them both down equally. If the firefighters must split up they will both have air left.

Jesse Wise
72A
### APPENDIX B

<table>
<thead>
<tr>
<th>Activity</th>
<th>SCOTT</th>
<th>MSA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of evals</td>
<td>%</td>
</tr>
<tr>
<td>Donning/Doffing</td>
<td>13</td>
<td>84.62</td>
</tr>
<tr>
<td>Pack ergonomics/comfort</td>
<td>13</td>
<td>85.33</td>
</tr>
<tr>
<td>Mask-comfort/visibility</td>
<td>13</td>
<td>76.15</td>
</tr>
<tr>
<td>Communication</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-Low noise</td>
<td>12</td>
<td>86.67</td>
</tr>
<tr>
<td>-high noise</td>
<td>11</td>
<td>84.55</td>
</tr>
<tr>
<td>Search Maze</td>
<td>9</td>
<td>80.00</td>
</tr>
<tr>
<td>Ladder Raise</td>
<td>8</td>
<td>86.55</td>
</tr>
<tr>
<td>5 cut (Ventilation prop)</td>
<td>5</td>
<td>90.00</td>
</tr>
<tr>
<td>Bottle change</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-Standing (buddy change)</td>
<td>5</td>
<td>92.00</td>
</tr>
<tr>
<td>-Bench or kneeling</td>
<td>6</td>
<td>95.00</td>
</tr>
</tbody>
</table>
## APPENDIX C

### SCOTT SCBA evaluation comments

**Donning/Doffing**
- ¼ turn connection of regulator can be turned the wrong way - 2 times
- No real change - 2 times
- Liked no chest straps - 1
- Pack equipment hard to reach
- Bottle valve hard to operate - 3
- Class-1 waist belt difficult - 3 times
- Straps stayed tight
- Clunky, sat low on back

**Pack - Ergonomics (Fit)/Comfort**
- Comfortable fit - 3 times
- Well balanced
- Would like a chest strap - 2 times
- Comfortable without chest strap - 2 times
- Hurts
- Not as comfortable as MSA
- Did not distribute weight well

**Mask - Comfort/Visibility**
- Fish-eye looking down - 7 times
- Bulky amplifier - 4 times
- Fits well with helmet
- Eyes water from air flow
- HUD visibility is so/so
- Nose cup too tight
- Great visibility
- Both Medium and Large fit well
- Buckles didn’t fit with helmet
- Limited peripheral
- Cumbersome
- Did not like at all

**Communications**
- Amplifier had feedback
- Too hard to hear when low on air - 2 times
- No issues
- Voice amplifier was clear but too big

**Search Maze**
- No real improvements over current model
- No issues
Difficult to search with mask distortion
Pack doesn’t ride well on back when searching on knees - 2 times
OK

Ladder Raise
Comfortable
No real improvements over current model
On air affected depth perception when looking down’

Roof Prop - 5 cut
Easy to cut in
No change from current pack

Bottle change
Easy - 3 times
Minimal time needed to change bottle
Quick/simple

Other comments;
I did not feel starved for air when worked out treadmill.
The design of this pack makes it easy to wear for extended periods without strain on back.
I did not like anything about this pack.

MSA SCBA evaluation comments

Donning/Doffing
Easy-6 times
Not any different than current pack-3 times
Straps well located

Pack- Ergonomics (Fit)/Comfort
Very comfortable-6 times
Fit better than SCOTT
Like the adjustable waist strap-4 times
Pack moves with body-3 times
Wish the straps adjusted to small size
Like the wider shoulder straps-2 times

Mask- Comfort/Visibility
Good fit-2 times
Easy to breath in standby-2 times
Best mask I have ever used-3 times
Very light/no attachments-4 times
Sleeker than SCOTT no distortion-2 times
Good visibility-4 times
Taken back at how superior this is to the SCOTT mask
Blew SCOTT mask out of the water

**Communications**

Similar to current system
Not as loud and clear as SCOTT
Good-2 times
Clear, cuts out breathing sound automatically -2 times
Some feedback from chest speaker
Impressed with chest speaker
Picked up voice well
Like the muting factor on chest speaker- 2 times

**Search Maze**
Comfortable-3 times
Moved with users
Flexible movement
Easy to move-2 times

**Ladder Raise**
Comfortable-2 times
No issues

**Roof Prop-5 cut**

No issues
Very comfortable
Easy to work in-2 times

**Bottle change**

Quick connect is easy-5 times
Simple

**Other comments;**

This is the pack I would wear on the fireground, the SCOTT didn’t even compare.

Highly recommend G-1 over SCOTT. The buddy breather depleting the lowest bottle first is unsafe.
APPENDIX D

<table>
<thead>
<tr>
<th>Engine</th>
<th>Reserve</th>
<th>Ladder</th>
<th>Aid Car</th>
<th>Command</th>
<th>Air Truck</th>
<th>Training</th>
<th>HazMat</th>
<th>75 Spare</th>
<th>Academy</th>
<th>Sta spare</th>
<th>Ric</th>
</tr>
</thead>
<tbody>
<tr>
<td>E45</td>
<td>E451</td>
<td>L46</td>
<td>A71</td>
<td>B46</td>
<td>R46</td>
<td>6</td>
<td>6 (hour)*</td>
<td>5</td>
<td>10</td>
<td>1</td>
<td>21**</td>
</tr>
<tr>
<td>E47</td>
<td>E461</td>
<td>L74</td>
<td>A74</td>
<td>D7</td>
<td>R74</td>
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<tr>
<td>E71</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>10</td>
<td>8</td>
<td>3</td>
<td>5</td>
<td>5</td>
<td>2</td>
<td>6</td>
<td>6*</td>
<td>5</td>
<td>10</td>
<td>11</td>
</tr>
</tbody>
</table>

| Packs | 40 | 32 | 12 | 10 | 5  | 0  | 6  | 6*  | 5  | 10  | 11  | 0  | 137* |

| Bottles-New | 80  | 64  | 24  | 10  | 5  | 20  | 0  | 0  | 0  | 10  | 0  | 36  | 0  | 249 |

| Hour Bottles | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 12* | 0  | 0  | 0  | 21** | 33** |

| Bottles-retro | 0  | 0  | 0  | 0  | 0  | 0  | 12  | 0  | 0  | 0  | 20  | 0  | 0  | 32  |

| Trans-fill | 40  | 32  | 12  | 10  | 0  | 0  | 0  | 0  | 0  | 5  | 10  | 11  | 0  | 120  |

| Mask | 10  | 8  | 3  | 5  | 0  | 0  | 0  | 0  | 6  | 1  | 15  | 0  | 0  | 0  | 256*** |

| SABA | 0  | 0  | 0  | 0  | 0  | 8  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 8  |

| RIC**** | 10  | 8  | 3  | 2  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 23** | 23**** |

Station spare bottles

- **6, 1 hour pack with no pass alarm**
- **RIC**
- 47-4 (1 in pack 3 in rack) 4
- 45-4 (1 in pack 3 in rack) 4
- 46-2 (1 in pack 1 in rack) 2
- 71-2 (1 in pack 1 in rack) 2
- 72-2 (1 in pack 1 in rack) 2
- 73-2 (1 in pack 1 in rack) 2
- 74-2 (1 in pack 1 in rack) 2
- 75-2 (1 in pack 1 in rack) 12
- 76-2 (1 in pack 1 in rack) 2
- 77-2 (1 in pack 1 in rack) 2
- 78-2 (1 in pack 1 in rack) 2

Total station spare bottles 36

****1/first out, reserves, A71 and A74